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THE AMERICAN GAS LIGHT JOURNAL

ROMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME L.—No. 17. Whole No. 725. | NEW YORK, MONDAY, APRIL 29, 1889. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y. AS SECOND CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, N. Y.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $4.00 (17 shillings—20 francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

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[OFFICIAL NOTICE.]

Twelfth Annual Meeting Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION,
QUINCY, ILLS., April 26, 1889.

The Twelfth Annual Meeting of the Western Gas Association will be held at Cincinnati, Ohio, on the 15th, 16th and 17th days of May. The "Grand" which has been secured by the local Committee of Arrangements for our headquarters, has been lately refitted, as well as greatly improved in all respects, and is now one of the finest hotels in the country. The business sessions of the Association will be conducted in a large room within the hotel building, and for quiet, comfort and coziness, the arrangement is all that could be desired. The hotel rates have been reduced to $3 per day to the members of the Western Gas Association and their guests. It may be well to bear in mind that the Grand Hotel is but one block away from the Grand Central Railway Depot, at which place about all the delegates to attend the convention will arrive. The convenience of this speaks for itself.

A reduction in transportation rates has also been secured, for those who will be in attendance, in the territory of the Central Traffic Association, which is bounded on the East by Pittsburgh, Buffalo and Toronto; on the North by the line of, and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the North line of Cook County, Illinois; on the West, by the West line of Cook County and the Illinois and Mississippi rivers to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the South by the Ohio river. Not later than two weeks before the date of our meeting, the Secretary will mail to every member (and to those who will kindly inform him of their intention of joining our Association) the necessary information as to how the reduction in railway fares can be obtained.

I am gratified to be in position, owing to the courtesy and promptness with which the contributors of papers have responded to my appeal for the titles of their papers, to present the following index to the literary treat that is in store for the members. The list is appended:

"Meter Accounting: Do I lose any Meters?" by G. A. Hyde, Jr.

"On the Use of Crude Oil for Firing Bench Furnaces and Enriching Coal Gas," by J. H. Woodmansee.

"Incandescent Gas Lighting," by John McIlhenny.

"Inclined Retorts," by R. D. Walsh.

"Retort House Work," by Geo. T. Thompson.

"Retort Furnaces for Burning Coal," by K. M. Mitchell.

"Fuel Gas," by Chas. R. Faben, Jr.

"Points on the Management of Small Gas Works, as Deduced from Twenty-five Years' Experience," by an Old Gas Manager.

Mr. Walter L. Brown, who is now in charge of the works at Evanston, Ills., has given a conditional promise of a paper, in which he proposes to deal with "A Winter's Experience with a Springer Plant."

In addition to the above alluring array of subjects, our gifted Honorary Member, Prof. T. C. Mendenhall, of Terre Haute, Ind., has kindly consented to favor us with a lecture on the "Nature of Light." As the members of our Association ardently desire to absorb all the information that there

is to be had on this very subject, it is safe to promise the genial Professor an attentive audience.

There has been a very strong undercurrent of sentiment all drifting in the direction of causing the "Question-Box" to assume a more prominent part in the Cincinnati convention than that hitherto played by this important and useful receptacle. In order that a systematic and comprehensive arrangement and classification of the questions be assured, the members can greatly aid the Secretary should their queries be forwarded to him at Quincy by the 5th of May. I would also call attention to the fact that, although April 25th is now a back number on the calendar, the authors who are to contribute papers, in order that the latter may be printed according to the terms of the resolution passed in 1888, should forward their MSS. at once.

To go back a step, it might be well to call attention to the advisability, if not the necessity that exists for members seeing to it that their rooms in the hotel are secured at a day in advance of the meeting. The Grand is a large hotel, it is true; but as every holder has a limit beyond which it is not safe to go, and as the Western is fast becoming a "big Association," our members should give due heed to the above hint, in order that disappointment as to proper accommodation may not be experienced by any.

Copies of our by-laws, containing our membership list and application blanks for those who wish to swell the ranks of the "Western," will be mailed by the Secretary to those who desire them.

In accordance with the plan outlined in the last issue of the JOURNAL, to the effect that special arrangements were in process of perfection to enable those who desired to travel in special cars, from Chicago to Cincinnati, on the evening of May 13th, it may be said that those who desire to avail themselves of this programme should purchase tickets by the "Monon route." Fred R. Persons, 75 North Clinton street, Chicago, should be notified of this intention at as early a date as possible, so that provision can be made for the accommodation of all.

A. W. LITTLETON, Secretary.

BRIEFLY TOLD.

MORE ABOUT THE WESTERN MEETING.—Our readers must remember that this is the season when the buds that were sealed last fall, merely that they might be protected from the rigors of winter, are opening in their green-clad beauty under the softening influence of the moistly warm wooing of the sunshine of late April and early May. Perhaps the idea has thus far been hazily concealed by the language in which its expression was sought to be conveyed, but to drive the mist away so that all may become clear, we have only to remark that Secretary Littleton's "official notices" bear no kinship to the fruit that is known as the chestnut. He has the springtime for his harvest—lucky husbandman that he is—hence his notices are like unto the bursting buds, in that some new feature is developed in each leaf from his authorized pen. Prosaically recorded, his latest circular always contains something that has not been published before. And so it is with the current notice from Quincy. Of course, the current notice speaks for itself, as each of its predecessors did; but we would ask that it be carefully perused, so that each member, and those who are now thinking of becoming members, may be thoroughly conversant with the pleasure and profit in store for him or them, at the approaching conclave, to be held in the Grand at Cincinnati, something over a fortnight from now. The paper list previously announced was a right good one, but here we see the enlistment of another recruit, who is down to speak on that seemingly old, but realistically new, subject of the vagaries and difficulties of managing a small gas works. Any gas manager who has had 25 years' experience in the management of works, be the latter large or small, cannot fail to present an interesting recital. We are sorry that the quarter centennarian gives no clue to his identity just now, but as mid May will unfold him, we can only wait in patience, pretty well leavened with curiosity, for the story that goes back to the days of rebellion and strife. These were piping times among the gas men—times that were dark in more respects than one. We also have the conditional promise of a paper from Evanston, Ills., by the worthy successor of a sterling predecessor, Mr. Cosgrove, and we might amend that by saying the Messrs. Cosgrove—father and son—were ever ready to impart to their fellows the knowledge gained by them in the conduct of the Evanston plant, and it is quite in keeping with the surroundings and practice of that beautiful city that as the Cosgroves were so should their successors be. Accordingly we hope that the paper of Mr. Brown shall not be conditional, but absolute, in respect to its presentation. The subject, too, is one that all will be glad to hear ventilated. In connection with the paper list, it should be further remembered that the President's address is not catalogued. The observant gentleman whose letters are mailed to the Vincennes, Ind., Post Office is about as keen a discriminator as any in the ranks of the fraternity, and as he usually—if not invariably—manages to maintain a good grasp of the live questions of the day, we expect to hear from him in good round voice about the virtues and vices of uncarbureted fuel gas, and incandescent electric lighting as well. Whether or not he speaks to these topics, it goes without saying that President Ramsdell's address will be sound, without dead weight; pronounced, but politic—and the latter because guarded by the lines of thoughtful observation—and with only one meaning.

In respect to the arrangemements for the transportation, housing and assembling of the delegates, we have only to say that those in charge thereof manage to add each week some striking evidence of their forethought and watchfulness. Those who are on the membership lists of the Western ought to repay their representatives in charge of the preliminaries with a unanimous attendance, and those who are not yet on its rolls ought to arrange it so that their applications for entrance shall speedily be in the hands of Secretary Littleton, who earns new laurels with each year that holds his occupancy of his present arduous post.

THE Louisville meeting of the American Water Works Association was a complete success. The papers promised were not only read, but were of an unusually high order, and the outcome of one was especially noteworthy. This applies to the contribution, by Mr. Russell, of St. Louis, Mo., on the subject of "Standard Water Pipes," the reading of which was followed by the appointment of a committee—Mr. Russell, Dennis Long & Co., and the Shickle, Harrison & Howard Company—to establish a standard of weights for water pipes. Perhaps some one of our associations—why not the Western?—might follow suit in the appointment of a like body charged with the duty of establishing a standard of weights for gas mains. The Mammoth Cave visit was carried out, too, at the water works magnates' meeting—and not a man was lost. Hereafter we must address ex-Secretary Decker, as President Decker, for the erstwhile Hannibal (Mo.) gas man is now the chief executive of the American Water Works Association. Need we say that he is the right man for the place? The query answers itself.

AT the annual meeting of the Columbus (Ohio) Gas Light and Coke Company, the following Directors were chosen; Messrs. P. W. Huntington, W. G. Deshler, W. B. Hayden, Geo. McDonald, D. E. Putnam, Louis Lindeman, A. Thomas, R. A. Platt and Emerson McMillin.

THE postponed hearing on the petitions of various gas companies of Massachusetts for the right to manufacture water gas—to have been had before the Gas Commissioners in Boston on the 17th intst.—was postponed to 10 A.M. of the 22d prox. This is the fifth postponement, and some of our Eastern brethren are beginning to assert that the desire for water gas in Massachusetts is not so rampant now as was the case a year or so ago.

The Method of Burning Coal Tar at the Austin (Texas) Gas Works.

[Read at the meeting of the Southwestern Gas Association by Mr. A. E. Judge, and communicated to the JOURNAL by the author.]

The method at the Austin Gas Works for handling and burning coal tar is as follows: For pumping the tar from wells a 3-inch suction pipe is used to reduce friction, which is considerable with smaller pipe. By means of a reducer and nipple the 3-inch suction pipe is connected with the bottom of a No. 4 pitcher-spout cistern pump. One man can rapidly and easily pump tar with this arrangement in the coldest weather. For hand work we prefer a cistern pump, as both the top and bottom valves can be readily gotten at, if clogged in any way. The tar is pumped into coal scuttles, which make convenient sized buckets for handling the tar, which is poured into a 16-gallon iron tank in front of stack at side of bench. The tank sets on a small brick pier, bringing bottom of tank about 2 inches higher than level of top of the Parson's tar burner, which injects the tar into furnace through a hole above furnace door. A coarse sieve fits in top of tank, preventing any solid matter from being poured into it; and in order to keep the tar in a fluid condition, so that it freely flows to the burner, a coil is placed in bottom of tank, through which steam can be passed to warm the tar when desired. The hole through which the tar burners project into furnace is nearly closed by an iron cover, and the principal air supply passes up through the grate bars, which are covered with a thin fire of coke dust that burns slowly and heats the main air supply.

We are heating five retorts, carbonizing 6,750 pounds coal, with a consumption of 90 gallons tar and 600 pounds of coke screenings, daily.

Keeping Gas Companies' Accounts.

[The "Second Prize" in the competition (Series IX.) for papers on subjects allied to the gas industry, as instituted by the *Gas and Water Review*, was awarded to Mr. W. H. Humphreys, of West Hartlepool. The paper is appended.]

In penning an article on the keeping of gas accounts, we must, at the outset, consider that, with the limited space at our disposal, we shall be unable to give more than a very concise description of the method recommended for adoption; anything like an exhaustive treatment of so comprehensive a subject must necessarily be out of the question. The principal books required are those used for recording the inspections; meter registers; collecting, gas rental, collectors' and office cash books; workmen's time books, wages lists; books for entering the residual products sold, day books, cash and invoice books; journal, ledgers, balance book, and numerous others of subsidiary importance, such as departmental books for recording time and material, depositors' books, black book, etc. We will give a general description of these, and endeavor, if possible without sacrificing clearness to brevity, to point out their important functions.

The meter inspection books—which should be of a handy portable size—are for the inspector to record the meter states, and are arranged in order that he may visit each consumer within his district without any waste of time, the most expeditious routes, commencing from a given point, being always selected. The books should be arranged to show at a glance exactly the information required, the following plan being recommended as the most suitable: There should be a space for the name and address of the consumer at the head of the page, and directly underneath, a line, divided into spaces for showing the maker of the meter in use, its position, number, size, and the rent per quarter; further spaces are required for describing the cooker, fire or heating stove, and the rent charged for each. In a column running to the bottom of the page, the months December to December are printed with sufficient space to allow of two or three entries for each month; two more parallel columns are required, the first for placing the state of the meter opposite the month when the inspection took place, and the other for remarks on change of tenant, new meter fixed, or anything of that description requiring notice. As the three columns only take up a comparatively narrow space, the life of the book may be extended for a further period of one or two years by adding similar columns, if circumstances will permit of that arrangement.

From these books the states and alterations are copied, at regular intervals, into the gas meter register, more particularly for office use and reference. This book may be arranged to last for any suitable period, and as each consumer is indexed, his consumption may readily be referred to. Keeping these books entails a vast amount of labor, however, for all practical purposes the inspecting books should suffice. At the date arranged for the expiration of the quarter, the inspectors proceed to record the states; as this generally takes some days to accomplish, an early start is advisable, to allow of everything being completed in good time. From this record the accounts are prepared; their form should be as simple as possible, consistently with showing the necessary information and charges. The states of the meter at the present and previous inspections should be shown, so that the difference, giving the quarter's consumption, may be readily understood; the price per 1,000 should also be clearly stated, and the amount carried into a money column for the purpose of distinctness. We allow a line for deduction of the discount, and then separately shown are the rent charges for meter, cooker, stove and gas fire, space for the total being ruled off at the bottom. Large consumers' accounts are then prepared from the consumption shown, and the gas accounts are practically ready for the collectors to arrange their arrears, and make the necessary finishing arrangements in readiness for their rounds.

Before, however, the collectors proceed with their collecting, particulars of each account must be entered into the gas rental book. As this is a book of prime importance, it is necessary to give a somewhat detailed description of it. It is preferable to have it large enough to enter from 40 to 50 ordinary consumers' accounts on each page, and from the following enumeration of the necessary columns it will be obvious that a good width, to allow of clearness of entry, will be an advantage. First we have columns for the name and address, then follows the "current number" of the account; the next column—inter-ruled with faint blue line spaces for facilitating casting—is for the consumption; the three following columns are for the meter, cooker, and gas stove and fire rentals, and if necessary there may be another for any other items, as hired lamps, etc. We then have the "current gas rent" column, where the gross total of each account is entered. For the purpose of showing the arrears we must have a column for arrears number, and another for "arrears brought forward." After this the "discount column" will be most conveniently placed, and a further one for "when received;" this may be divided into three, the months written in at the head, and merely the dates placed in each column under their respective months; naturally the next column is for the "amount received," and then we have four more columns for "arrears," "arrears collectible," "arrears uncollectible," and "remarks." Particulars of all the accounts, including those for public lighting and under contract, are entered, and the result is that we have a complete record of the consumption, the amounts charged for appliances, and the total amount owing; the discount allowed, the date the account is paid, and the amount paid; also the amount owing for arrears. Those accounts not paid at the expiration of the quarter are transferred into the "arrears" column;" if "arrears collectible," they are carried on to the following quarter, where they are entered as "arrears brought forward;" if the accounts are dead they are placed in the "arrears uncollectible" column, to be dealt with through the journal. When all the entries are complete the totals are obtained, which we will deal with further on.

The collectors' and office cash books are for the purpose of entering each consumer's name, number, discount allowed, and the amount paid. Four money columns are necessary, one each for discounts, gas rents, sundries and total. Each payment in the gas rents column is posted in the "amount received" column of the gas rental book to the credit of the consumer paying, with the date of payment, and the discount allowed. The column for sundries is for entering the ledger accounts and sundry items; the total of each day's collections being carried into the total column and paid to the cashier, who places his signature opposite the amount he receives.

For preparing those entries for the cash-book we should have an intermediate book called the "daily collections." The total amounts received for gas rents each day from each book are entered therein; the sundries being classified and carefully ruled off.

Our next proceeding is to enter those amounts on the debit side of the cash-book. We place the daily total of the gas rents received in the margin, and the total of the whole in the "cash received" column. The ledger payments are then entered, each amount being carried direct into the received column. Other items placed to the credit of sundry accounts are classified, and their respective totals only, carried into the received column. In addition to this column we should have columns for "abatements" and "bank." All amounts paid to the bank are entered therein opposite the dates of payment. On the credit side all payments made are entered to their respective accounts or persons in the "cash paid" column, and checks paid by bankers in the bank column. When all the entries for the month are completed, we cast up the bank column on the credit side, ascertain the total net amount paid by the bank during the month, and then enter it, in the bank's name, on the debit side in the "cash received" column. We next cast the amounts paid to the bank during the month, and likewise make an entry in the bank's name on the credit side in the "cash paid" column. We thus obtain from those columns the amounts received from collections and from the bank; and the payments made to sundry persons and to the bank.

For the purposes of the cash statement, after deducting the balance at the commencement, we compare the bank columns and ascertain the amount owing by or due to the bank, which, with outstanding checks, will balance with the bank pass book. We then compare the "cash received" and the "cash paid" totals, the difference being the amount of cash in hand.

We will now deal with the residual products; the first in importance is coke. If sent off by rail it must be weighed on the weigh-bridge on the works, or by the railway company; the tare, gross and net weights, truck number, and the amount entered in the "coke credit book;" advice notes should be sent off each night, and the invoices monthly. Coke carted away on order for local firms should be similarly entered, and an advice given to the cartman. The cash sales are entered through the "coke cash book," and the cash paid in at regular intervals is entered through the cash book to the credit of coke. This formula will apply also to breeze, sulphate, tar and ammoniacal liquor.

The day-book is for showing goods sold on credit and for giving particulars of private accounts; four money columns and one folio column are required. The first column on the extreme left of the page is for balancing purposes, the next for the journal folio, whilst the center of the page is for writing in all necessary particulars; the next or third column is for entering the cost of *each* article, the fourth for the gross cost, and the fifth for the total. The difference between the third and fourth columns is entered in the balancing column, consequently the

amount entered in that column and the third column equal the amounts entered in the fourth column; the fifth column likewise balances with the fourth column, thus making doubly sure that our entries and calculations are correct. In entering the goods from the rough books it is advisable to keep those for each department or account together; taking the fittings first, coke, tar, etc., in order. We also enter through this book, from an abstract of the workmen's time books and wages lists, the charges to revenue for all labor and material of every description, suitable accounts being arranged for each department: those departments being debited through the journal with the amounts, the paying accounts receiving credit at the same time. Capital charges for material taken from stock and labor by the company's workmen for new buildings, plant, mains, services, etc. (not being in place of old ones), will come through in the same manner.

The invoice book is for placing the invoices received for goods supplied and services rendered by others. The account to which each invoice is to be charged is debited, and the person named is credited with the amount.

We are now ready for the journal, which is provided with three columns, the first for the ledger folio, the second for debit, and the third for credit items. From the day-book we enter the names and total amounts to the debit of sundry persons for fittings, coke, tar, etc., supplied, and total the amount for each account into the credit column. We also debit the capital and revenue accounts, and credit the paying, stock, or other accounts. The two columns should balance and agree with the total in the day-book.

The invoice book is treated in a similar manner, only the amounts owing to each person are entered in the credit, and the total to the debit of suitable accounts in the other column. These amounts when entered should agree with the summary shown in the invoice book.

The cash book requires journalizing next. The totals only are taken, as the postings are done direct. We enter—as shown on the debit side—cash, for net amount received this month, in the debit column, and place that amount to the credit of "sundry accounts" in the credit column. With the other side of the cash book we reverse the order, "sundry accounts" being debtor to cash for net amount paid during the month, and "cash" receiving credit.

The amount and particulars of the gas rental book when completed for the quarter, must also appear through the journal. We take the "current gas rents" and enter the total to the debit of the consumers, and to the credit of gas revenue. Entering this debit to the consumers explains the reason for totaling the entries through the cash book to their credit, which will, with cross entries of discounts and bad debts, balance their account, with the exception of the balance for "arrears collectible."

The totals of the four books enumerated must then agree with the debit and credit columns of the journal.

We now bring the ledgers into use; their purpose is generally understood. They are arranged for showing the capital and revenue accounts, and the amounts owing by and to the company. The amounts appearing in the journal for goods supplied are posted to the debit of the persons obtaining them; and for goods supplied to the company, to the credit of the persons supplying them. From the cash book we enter on the credit side all amounts paid by customers for fittings, coke, tar, etc., and on the debit side the amounts paid by the company for goods received. The capital, revenue, and other charges are, in the same way, posted to their respective accounts.

To prove the correctness of our postings we must take a monthly balance; all postings to the ledgers are shown in columns for their respective months, opposite the names of accounts or persons. When cast, the totals should be found to agree with the journal totals. When balancing the ledgers, the debit and credit amounts in the balance book are cross-cast, the totals of each shown, and the net amounts standing to the debit or credit of each account or person are carried into columns for displaying them. These balances should, of course, agree with those in the ledgers.

Before, however, we can complete our accounts for the half year, we must journalize the closing entries. The principal objects are to show the stock to be carried forward, and to transfer to the debit of profit and loss account the revenue charges during the half year, and credit it with the sale of gas, residual products, etc., the difference being the net profit. The closing entries are all posted to their respective accounts and taken off into the closing entry columns of the balance book, and if correctly posted, the two will agree.

The "Gas Works Clauses Act, 1871," prescribes a form of accounts for those companies whose special Acts incorporate the "Gas Works Clauses Act, 1847." The form displays great judgment, and is remarkably adapted for obtaining simplicity and uniformity of accounts. From this statement there may be obtained, at a glance, from the capital account, such important information as the amount of the share and loan capital; the amount expended on plant, machines, storage, etc. The revenue account displays the receipts and particulars of the sale of gas and residual products; the expenditure for the manufacture, distribution, management, etc.; and the profits earned are likewise readily comprehended. It is well adapted for showing a complete working statement of the cost per 1,000 cu. ft. and per ton of coal carbonized.

In the enumeration of books given, we have endeavored to briefly describe a method of keeping accounts suitable to gas undertakings for readily obtaining the necessary statements and particulars, and for at once showing a full and complete statement of their affairs in accordance with the prescribed form mentioned.

All unnecessary complexity should be avoided; the accounts require to be complete and comprehensive, correct, and always adapted to display exactly the information required.

The Chemistry of Illuminating Gas.

Mr. Norton H. Humphrys is contributing a most ably prepared series of articles on this subject for the London *Journal*. The fourteenth article of the series is appended:

In 1876, M. Berthelot published the results of some experiments and researches on the gas supplied to Paris*; and these attracted a great deal of attention, as showing that the hydrocarbons in Paris gas were of a very different composition to those found in English gas, or, indeed, one might almost say, in samples of commercial coal gas from any other town. Whereas all other investigators had considered that the hydrocarbons consisted chiefly of the ethylene series, M. Berthelot found that in the Paris gas, benzol was the chief illuminating constituent. He remarks that all the pyrogenous carburets of hydrogen are, in his experience, allied by regular laws of transformation, and by such relations of equilibrium that the existence of any one of them at a cherry-red temperature brings about as a consequence the successive formation of all the others. He caused about 50 liters (1.76 cubic feet) of gas to pass very slowly through a small quantity—about one-half a cubic inch—of fuming nitric acid. The acid was subsequently diluted with water which caused a precipitate to separate, and this consisted of nitro-benzene, containing also toluole and other products. By weighing the precipitate the quantity of benzene may be approximately estimated. Applying this process with certain precautions, he satisfied himself that the gas contained 3 to 3½ per cent. of benzene. The absorption by bromine with similar gas was 3.7 per cent.; and that by boiled sulphuric acid, 1.8 per cent., including the water vapor. As this was 1.6 per cent., only 0.2 per cent. remains to represent the hydrocarbons absorbed by the boiled sulphuric acid. The residue remaining from the treatment with sulphuric acid was treated with bromine, and the absorption was 3.5 per cent. All the experiments are somewhat indefinite in character.

M. Berthelot divides the illuminants into three classes: 1. Those absorbable by fuming nitric acid, which may be regarded as benzol. 2. Those absorbable by boiled sulphuric acid, consisting of butylene, crotonylene, propylene, etc. 3. Those removed by bromine but not by fuming nitric acid, or by boiled sulpuric acid, comprising ethylene and acetylene. The benzol was determined as above described. A number of experiments were tried on the illuminants removed by passing the gas through a small scrubber charged with lumps of pumice soaked in concentrated sulphuric acid. The acid, being allowed to stand in a compartment purposely left at the base of the scrubber, gradually separated from the hydrocarbons, which formed a layer of liquid floating on the surface. About one ounce of the liquid hydrocarbon was obtained from 3,500 cubic feet of gas; and this was subjected to further examination by fractional distillation, analysis of the fractions, etc. The following are the conclusions arrived at, stated in parts per million volumes of gas:

Benzol (C_6H_6)	30,000 to 35,000
Acetylene (C_2H_2)	1,000 about
Ethylene (C_2H_4)	1,000 to 2,000
Propylene (C_3H_6)	2.5
Allylene (C_3H_4)	8.0
Crotonylene (C_4H_6)	31.0
Terene (C_5H_4)	42.0
Sundry carburets	98.0

From this it would appear that for all practical purposes the illuminants may be regarded as benzol, as that substance is stated to constitute more than 90 per cent. of the total absorbable hydrocarbons.

* See London *Journal*, Vol. XXVIII., p. 94.

M. Berthelot concludes his paper by noticing several reactions which he has found by experiment to take place at a red heat with dry distillation. These are: 1. The reciprocal and direct metamorphosis of the four fundamental hydrides of carbon, acetylene (C_2H_2), ethylene (C_2H_4), methyl (CH_3), and marsh gas (CH_4), which constitute with hydrogen a system in equilibrium by which all four are formed at a cherry-red temperature at the cost of the particular one among them taken as a starting point. 2. That free marsh gas directly engenders ethylene and other hydrocarbons of the series $(CH_2)_n$. 3. That free acetylene generates benzol and hydrocarbons of the series $(C_2H_2)_n$, amongst which benzol predominates on account of its greater stability. The four fundamental bodies will also combine two by two to form more complicated products. To prevent confusion it may be as well to remark here that the boiled sulphuric acid above referred to is a different substance to the fuming sulphuric acid now generally preferred as an absorbant for the whole of the condensable hydrocarbons in coal gas. Boiled sulphuric acid always retains a little water, and its constitution may be represented thus: 12 (H_2SO_4) H_2O. Fuming sulphuric acid consists of one equivalent of hydrogen sulphate (popularly known as sulphuric acid) combined with one equivalent of sulphur trioxide (anhydrous sulphuric acid), and its composition is: $H_2SO_4SO_3$.

M. Berthelot's conclusions were not allowed to go unchallenged. Professor Dittmar tried a number of experiments with Glasgow gas. He found that fuming nitric acid would absorb ethylene as well as benzol; and also that when a mixture of benzolated hydrogen, containing 6 per cent. of benzol, was shaken with water, about two-thirds of the benzol was dissolved from the gas. From this fact he concluded that but little of the benzol that may be present in the gas as it issues from the retort would survive the process of purification. And it may therefore be worth while to examine crude gas both for illuminating value and for benzol, so as to ascertain if any important loss takes place from this source in practice. By passing dried Glasgow gas over a coil of vulcanized sheet india rubber (which he found to be capable of absorbing the benzol without touching the other hydrocarbons) and then through bromine, he obtained a bromide which was decomposable by alcoholic potash, and therefore could not be a bromide of benzol. The bromine, after treatment with the gas, was washed with dilute caustic soda, dried by means of fused chloride of calcium, and distilled. The distillation point, and percentage of bromine, showed that the substance consisted of bromides of hydrocarbons of the ethylene series, in which ethylene was largely represented. From this he concluded that the hydrocarbons in Glasgow gas consisted chiefly of ethylene and bodies belonging to that class, as had always been supposed. One important point against the conclusions of M. Berthelot is the illuminating power of Paris gas. As will presently be seen, benzol is much more powerful as an illuminant than ethylene and similar hydrocarbons; and the composition as above stated should give a gas of very high photometrical value, notwithstanding the low percentage of illuminants. In a theoretical sense it is a perfect gas. But it is notorious that the quality of Paris gas is only about 13 candles—a quality that would not be tolerated in many of our English towns. If it really contains 3 per cent. of benzine, the only conclusion available is that it is largely diluted with nitrogen or carbonic acid.

But the theory that the illuminating value of coal gas is due rather to easily condensable vapors of the benzol class than to permanent gaseous hydrocarbons, such as ethylene, has received substantial support. Mr. G. E. Davis, writing to the *Chemical News*, says the older analyses of coal gas gave but a very poor insight into its composition, and that many of the deductions are not worth the paper they have been printed on. The real and most important constituents of coal gas have been overlooked. It was supposed that the greater portion of the illuminants were ethylene or liquids of such low boiling point as to be reckoned practically with the permanent gases. Lengthened investigations had satisfied him that a great mistake had been made on this point, and that the chief illuminants in coal gas were vapors of easily condensable hydrocarbons, commencing to boil at or below 65° Fahr., and containing many hydrocarbons even up to solid naphthaline. These illuminants were easily absorbed by olive, rape, or even hydrocarbon oils; and a ton of good gas coal would yield more than four gallons. The residual gas would possess a very feeble luminosity. Mr. Davis said that these hydrocarbons were worth more than the original coal *plus* materials and labor, and therefore, that where gas was used for heating or cooking, it would be profitable to extract them. He proposed to call the fluid so obtained "crude benzol." The quality of this crude benzol would be greatly affected by the conditions of distillation, temperature, etc. If the heat was too low, more paraffin would be formed.

Mr. Davis entered into the details of his project at some length in a paper read before the Society of Chemical Industry, in 1883, which includes a large amount of information that he has collected on the subject. In the course of it he refers to the following published analyses, which in addition to the particulars we have already noticed, attempt some explanation of the character of the hydrocarbons. No. 1 is from the first edition of Bunsen's "Gasometry;" No. 2 from the second edition; and No. 3 is given by Dr. Fischer in *Dingler's Journal*.

Hydrogen	45.58	46.20	46.27
Marsh gas	34.90	34.02	37.55
Carbonic oxide	6.64	8.88	11.19
Carbonic acid	3.67	3.01	0.81
Sulphureted hydrogen	0.29	—	—
Nitrogen	2.46	2.15	1.01
Oxygen	—	0.65	—
Hydrocarbons.			
Ethylene	4.08	2.55	2.11
Propylene	—	1.21	0.37
Butylene	2.38	—	—
Benzol	—	1.33	0.69
	100.00	100.00	100.00

He appears to be of opinion that a comparatively large quantity of benzol vapor must have been present in all the samples of gas, for he says: "My own experiments lead me to suppose that coal gas is a mixture of hydrogen with those members of the methane and ethane series that are gaseous below freezing point; and the mixture is permeated to a greater or less degree with the vapors of all the volatile hydrocarbons found in the tar up to at least solid naphthaline." In one experiment which he tried, gas from Silkstone coal was passed through olive oil, with the result that the illuminating power was reduced to 8 candles, showing that the larger proportion of the hydrocarbons were removed. On heating the oil to 260° nothing distilled off, but on blowing steam through it a volatile hydrocarbon liquid was obtained, in quantity equivalent to about 4 gallons per ton of coal. In order to secure the free absorption of the hydrocarbons by the oil, it is necessary that the operation should be conducted at a temperature not much above freezing point. Mr. Davis gives full particulars of the experiments upon which his conclusions are based. In the course of a very elaborate examination of what he calls crude benzol, he found that it contained 50 per cent. of pure benzol; and taking his estimate of 4 to 5 gallons of crude benzol per ton of coal, it follows that one ton of coal will yield 2 to 2½ gallons. Since the specific gravity of benzol is about 0.9, the weight of this quantity would be 120,000 to 150,000 grains, which should be diffused through about 10,000 cubic feet of gas. This would give 60 to 75 grains per 5 cubic feet of gas; and, according to the experiments of Knublach, 120 grains of benzol are capable of yielding an illuminating value of over 14 candles. Therefore the value of the benzol yielded by coal is by itself equal to 6 or 7 candles, or nearly one-half that actually obtained in practice.

Mr. Davis was pursuing the subject from a different point of view to that in which gas engineers would look at it. His object was to extract the benzol as a profitable commercial operation; but we are rather concerned in endeavoring to see how it can be kept in the gas. The attention of Mr. R. B. Taber, of New Bedford, Mass., was attracted by these researches on the possibility of removing benzol by treatment with oil at a low temperature; and that gentleman read a paper on the subject to the New England Association of Gas Managers,* directing attention to the practical effect of this reaction on gas exposed to contact with cold tarry matters in the condensers or scrubbers, or any part of the purifying apparatus. He gives some tables showing the result of tests taken on the gas at New Bedford at two stations 2,000 yards apart, extending over a twelvemonth. In the winter, when the air temperature was below freezing point, the gas lost 8 or 9 per cent. of its illuminating power; and in summer, with a temperature up to 70°, it gained nearly as much. The experiments quoted by Mr. Davis were considered explanatory of these results, as showing that some benzol was condensed in the mains. Some fluid hydrocarbon obtained by exposing 17-candle gas to a temperature of 32° was exhibited at the meeting. About 3 per cent. of water vapor and 3½ per cent. of fluid hydrocarbon was deposited, but yet the gas was only reduced to the extent of 0.5 candle in value. The removal of the water would of course improve the value of the gas, so that the loss was to an extent compensated for. But it is scarcely correct to regard the results that follow the exposure of gas to a low temperature as nothing more than a simple condensation of vapors. There is every reason to suppose that, in addition, various chemical reactions come into play. And these reactions are of so delicate a

* See JOURNAL, March 17, '84, p. 124.

nature that it is scarcely warrantable to take the results obtained by distilling and fractionating the substances absorbed by oil or bromine, as actually illustrating the composition of the hydrocarbons as they exist in the gas. Looking at the matter in a plain, practical way, it is certain that the coal gas as supplied in this country is to all intents and purposes permanent under the usual conditions of supply. If allowed to travel slowly through pipes at freezing point or lower, as in the case of a lamp service carried up a wall to a bracket, some deposition takes place, which may consist of hydrocarbons, in addition to the freezing of the water vapor in the gas. It would be impossible for fluids to be deposited to any important extent in the winter, and taken up again in the summer, without the fact becoming apparent in some way or another.

Mr. B. H. Thwaite Errs in His Water Gas Figures.

Last week we published some comments by Mr. B. H. Thwaite, in *Engineering*, on the prospectus recently issued by an English company that proposes to establish water gas plants in that country. In the succeeding issue of the same contemporary a correspondent, under the *nom de plume* "Gas," wrote the following in respect to an error or errors in Mr. Thwaite's original presentation of the matter:

I have read with interest the letter from Mr. B. H. Thwaite, in your issue of the 5th inst., and trust you will allow me space to reply to it, the subject of water gas having for a long time engaged my attention.

As had already been done in the report on water gas, to which attention is drawn, Mr. Thwaite compares water gas with what may be called Siemens gas. The calculation, as given in the letter, is slightly in favor of Siemens or producer gas, but actually (owing to an error which has slipped into the calculation) it is in favor of water gas. Mr. Thwaite calculates the loss that would arise from the products of combustion of 12 grammes of carbon formed respectively into water gas and Siemens gas, escaping at a temperature of 500° C. into a chimney. The reaction for water gas is $C + H_2O = CO + 2H$, and its complete combustion with air is represented by $CO_2 + H_2O + 8N$, as given by Mr. Thwaite. In the case of Siemens gas, carbonic acid gas is first produced diluted with nitrogen from the atmosphere, thus: $C + air = CO_2 + 8N$, and this in passing through incandescent fuel takes up another equivalent of carbon, thus: $(CO_2 + 8N) + C = 2CO + 8N$. The complete combustion of this gas in air is represented by $2CO + 8N + 2(O + 4N) = 2CO_2 + 16N$, or for as much CO as contains an atom of carbon by $(CO + 4N) + (O + 4N) = CO_2 + 8N$.

Then, according to Mr. Thwaite's calculation for water gas, there will be 33,684 units of heat lost, and correcting his calculation for Siemens producer gas the figures stand

$$500\left[\begin{matrix} C & O_2 & 8N \\ (12 + 32 \times .217) + (8 \times 14 \times .244) \end{matrix}\right]$$

that is to say, 112 × .244, instead of 84 × .244, as in Mr. Thwaite's equation, or 18.438 units of heat lost instead of 15.122. Assuming with Mr. Thwaite that the units of heat produced by the combustion of the two gases are for water gas 125,208 units, and for Siemens gas 67,284 units, the ratio of loss in the case of the former will be

$$\frac{33.684 \times 100}{125,208} = 26.9 \text{ per cent.}$$

(not 25 per cent.), and in the latter

$$\frac{18,438 \times 100}{67,284} = 27.4 \text{ per cent.}$$

(not 22.4 per cent.), being 0.5 per cent. in favor of water gas, that is to say, a saving of 10 cwt. per 100 tons of fuel burnt.

This theoretical result is not cheering; but the monetary result obtained with water gas and with Siemens gas respectively, in actual practice for furnace work, is the point which chiefly concerns iron and steel manufacturers, and these results alone influence them in adopting water gas or not. The prospectus referred to by Mr. Thwaite does not furnish specific particulars on this important subject; but in a paper read by Mr. Wilson last year at the spring meeting of the Iron and Steel Institute he gave some indications, which being afterward supplemented by figures of cost of water gas, enabled Mr. Frederick Siemens to write you a letter, published in your issue of August 10 last. In that letter Mr. Frederick Siemens showed that to melt two tons of steel with water gas on the open hearth, and to make 140,000 cubic feet of producer gas of inferior quality (this inferior producer gas to be afterward more particularly referred to), the cost amounted to 18s. 3d., and that with the Siemens ordinary producer gas two tons of steel are melted on the open hearth, and 140,000 cubic feet of surplus producer gas of good quality are provided at a cost of 19s. 6d. These figures show an advantage of 74 per cent. in favor of Siemens gas, and considering the high prices taken by Mr. Siemens for coals and labor, it is probable that the advantage obtained in practice would be nearer 100 per cent. than 74 per cent.; or, in other words, to do a certain amount of work in regenerative gas furnaces with water gas would cost twice as much as to do the same work with Siemens gas.

But there is another consideration which should not be omitted in any comparison between Siemens gas and water gas, and that is that the former is produced for a definite purpose, and only so much is made as is required for that purpose. With the water gas apparatus, on the contrary, for two-thirds of the time during which it is at work an inferior gas, called in the report producer gas, must necessarily be made, whether required for use or not; if this inferior gas cannot be utilized it must be allowed to run to waste, and in that case the cost of water gas will at once rise to three times the stated cost of 4d. per 1,000 cubic feet, or 1s. per 1,000.

At the Leeds Forge, where hand forge work has to be done, requiring a high temperature to be concentrated on a small surface—in fact, a blow-pipe heat—water gas will be useful, and doubtless yields the economy stated in the prospectus, as compared with town gas, which it has replaced for that purpose. Water gas is also applicable for gas engines, as deposits in the passages and valves will be avoided by its use. But, allowing everything in its favor, what will practical men say of a process in which the plant can only be used for a third of the time in the production of water gas, whilst for two-thirds of the time it is employed it produces what, in many cases, will be a waste product? We surely are far from perfection here.

Crude Liquid Hydrocarbons as Heating and Lighting Agents.

By B. H. Thwaite, C.E.

[A lecture delivered before the Royal Institute, Liverpool, England.]

Whether the fecundity of submarine vegetation is as great as that of vegetation on land it is difficult to say, but if one may be justified in deciding on known geologic indications, it would appear that in the prehistoric period of our planet's history that submarine vegetation and life was quite as vigorous as that on land. In nearly every country there are indications that beneath the surface there are immense accumulations of liquid hydrocarbons, and the geographical extent or area and geologic assumptions of quantity of these accumulations of petroleum exceed those of the solid hydrocarbon known as coal. The author here that Lesqueraux's theory of the origin of liquid hydrocarbon is the correct one.

Lesqueraux is of opinion that petroleum is the result of the decomposition of marine plants, as coal is the result of terrestrial vegetation.

The chlorosperm of the palaeogic ages, with their simple bladdery formation and their green color, were fitted to perform in water the same function as the coal plants performed in the atmosphere.

As the result of terrestrial vegetation has been first woody tissue and then, by its decomposition, coal, so the result of marine vegetation has been, first cellular tissue filled with a kind of liquid carbon, and as the carbon is unalterable, the decomposition of the plant has left it free as fluid bitumen or petroleum.

A peculiar corroborative geologic fact is that in the lines of distribution of petroleum marine alga are found.

The author has already drawn attention in his brochure on "Liquid Fuel" to the saline accumulation accompaniments of the petroleum fields.

It is most probable that the area of the petroleum oil and salt deposits is coincident with that formerly covered with water, prior to the active influence of eruptive agencies, that have altered the configuration of the earth.

The petroleum oil field of the Aspheron Peninsula covers an immense area; the oil fields of the States of Pennsylvania and New York have an area of 369 square miles.

Some idea of the prolific character of the Aspheron oil fuel may be gathered from the following statistics: The export of astatki or the residual oils left from the refining processes equaled, in 1883, 87 millions of gallons; in 1885 this was increased to 175 millions of gallons. Assuming that 14 gallons of the astatki represented 160 gallons of the crude oil as it issues from the well, this output in 1885 would for export use alone have equaled nearly 5¼ million tons.

One firm of refiners at Baku have invested nearly two millions sterling in the refining, storage and distribution of oil in various conditions. The daily output of the astatki or residual and what we term crude oil, equaled, in 1883, 1,300 tons per day.

The exports of petroleum in 1864 equaled 88,791 tons, representing 634,200 tons of crude oil.

These weights had increased in 1886 to 2,321,435 tons, representing 16,581,700 tons of crude oil issuing in colossal streams from the American oil fields, and including the enormous weight utilized for home consumption, and that wasted. The petroleum as it issues from the wells has a constantly varying specific gravity ranging from a minimum 0.88 to 0.94.

According to the Russian expert, Guilishamtaroff, the following represents the chemical and thermic values of the light and heavy oils:

	Chemical constituents.	Thermic value in F. units.
Light oil—Carbon	86.3	
Hydrogen	13.6	22.628
Heavy oil—Carbon	86.6	
Hydrogen	12.3	19.440

The price of crude oil as it issues from the well is about 1 copeck per pound, or 1-20 of a penny per gallon, or about 14d. per ton.

The method of drilling an oil well now generally adopted is the American one; this consists in the erection, over the location where the well has to be drilled, of a pyramidical structure some 70 feet in height, with a base measure of 20 feet, and a summit measurement of 3 feet.

The well is usually 6 inches in diameter, and is drilled by falling chisel-shaped steel tools suspended from a cable which is raised by a steam winch; the tools are allowed to fall into the well from the height of 4 or 5 feet, the driller turning the drill as it falls, so that the hole is made circular; the drill and attached jars are made sufficiently heavy, about 1½ to 1¾ tons, to pierce the hardest rock.

Drilling depth varies from 500 to 4,000 feet. Occasionally, to assist the work of opening up the wells, highly explosive agents are used; this system is known as torpedoing. A canister filled with some 20 quarts of nitro-glycerine is lowered to the base of the well, the lid of the canister being provided with a percussion cap. All that is necessary to ignite the explosive is to allow a weight to fall on the percussion cap of the canister lid.

Besides the natural liquid hydrocarbon, petroleum, there are the artificial products known as blast furnace oil, shale oil, creosote and tar oil produced by the condensation of the volatile hydrocarbons. There is a striking resemblance between the natural and artificial product: the natural one is, however, the richest in calorific units; a comparison between the two agents will be given further on. The extended application of the artificial crude liquid hydrocarbon has stimulated the production, and now few blast furnace coke ovens are unaccompanied with means for the condensation of the volatile hydrocarbons evolved during the coking processes, and the production of oil from shale is also being considerably amplified.

It is to be desired that the means of production shall increase *pari passu* with the extension of the application of the natural product, otherwise there is the danger that the increased price due to inadequate supply will make the economic application impossible.

Some 10 or 12 years ago considerable attention was given in this country to means of applying the crude and natural hydrocarbon. This attention culminating in trials by the Government, at Woolwich Arsenal, had the effect of raising the price of crude oil from ½d. a gallon to 4½d., equal to 900 per cent of a rise. The result was complete attestation of its use.

When the author first devoted his attention to the use of the crude artificial oil, the price varied from ¾d. to 1d. per gallon. The price has already increased 2½d., and the abnormal demand in excess of production is the cause of this serious increase. It behooves the producers, therefore, to increase the supply in such quantities that shall prevent the price from increasing to a limit that shall render the continued use impossible, as the evil effect of such a result would fall heavily on the producer.

As the author hereinafter statistically explains, if the long talked of crude oil pipe line from Baku to Batoum were completed, crude natural petroleum would immediately become a formidable competitor with coal for all the Mediterranean and Orient-bound steamers, but the influence of the Baku refiners is at present too formidable to allow of the desirable means of distribution to be accomplished. Such a desideratum could not fail to be of colossal advantage to the Exchequer of the Russian Government, as it would prove an incalculable stimulus to the development of the Aspheron hydrocarbon liquid treasures. It may here be stated that the discovery of the mineral oil wealth of Pennsylvania and New York permitted the victorious but financially crippled Northern States to re-establish and maintain their financial solidity.

In order to obtain an accurate estimate of the value of the two liquid hydrocarbon agents, the author obtained two average samples of Russian astatki and blast furnace (coke oven) oils; the former from Baku, the latter from Bairds, of Glasgow. The samples were submitted for chemical analysis to Mr. Alfred Allen, of Sheffield, F. C. S. and President of the Society of Analysts, and for calorimetric estimation to Mr. William Thompson, F. R. S. Ed., of Manchester.

The method of calorimetry is decidedly the most useful in determining the exact and actual heat value of a fuel, and we owe this useful heat measuring invention to the illustrious French savant, Lavoisier.

The author suggested, as a means of testing the oil, the employment of asbestos, soapstone, or pumice stone or other refractory and porous material, carefully weighed and then immersed in the oil, and then placed in the crucible of the calorimeter. The exact weight of oil used can thus be ascertained. By this means the combustion of the oil rapidly and completely can be ascertained.

The Chemical Analyses.—The Russian astatki, costing £5 f.o.b. at Liverpool, was as follows:

	1st Sample.	2d Sample.	Average.
Carbon	84.94	84.59	84.9
Hydrogen	13.91	14.05	13.9
Oxygen by difference	1.13	1.36	1.2
	100.00	100.00	100.00

The calorimetric test with the Russian astatki gave 18611.2 Fahr. units, equivalent to pounds of water from and at 212° Fahr., 100° Cent. Converted into steam by one pound of the oil 1928.

The theoretical calorific value calculated with Faure and Silbermann's coefficients gave 20.927 units or 11 per cent. in excess of the calorimetric value.

The chemical analyses of the blast furnace oil costing £2 10s. f. o. b. at Liverpool was as follows:

	First Sample.	Second Sample.	Average.
Carbon	83.380	83.900	83.640
Hydrogen	10.530	10.650	10.590
Sulphur	0.087	0.088	0.0875
Oxy. by difference	6.003	5.872	5.9385

The following table gives particulars of a series of analyses of varied qualities of solid gaseous and liquid hydrocarbons:

Character of Fuel.	Analyst or Authority.	Chemical Constitution. C.	H.	O.	Sp Gr	Calculated calorific value. B. U.
Average of 5 samples	St. Claire	86.9	12.4	0.8	0.906	20.316
Baku petroleum	Deville	—	—	—	—	—
Baku, Astatki	Allen	84.9	13.9	1.2	0.88	20.929
Pennsylvania heavy crude oil		84.9	13.7	1.4	0.938	20,736
Caucasian heavy crude oil	Guilishambaroff	86.6	12.3	1.1	0.084	20,138
Caucasian light crude oil	Do.	86.3	13.6	0.1		22,027
Virginia petroleum	Valerius	88.3	13.9	0.8	0.928	18,183
Astatki	Do.	87.1	11.7	1.2		19 832
Shale or dead oil	Church	86.48	7.06	6.46	—	—
Blast furnace oil		83.64	10.60	5.94		16,080*
Average of 98 samples English coal	Urquhart	80.0	5.0	8.0	1.25	14,112
German coal	Bunte	72.0	4.67	10.98		13 404
Cellulose	Valerius	44.00	6.17	49.10		65,51
Wood	Do.	39.00	Combined water.	40.00		Actual exp't 76.85

* Calculated.

Taking the average thermic value of the natural liquid hydrocarbon (astatki) to represent 20,000 bushels, and that of coal to represent 14,000 bushels, the ratio for a unit of weight is 10 to 7 in favor of the liquid hydrocarbon.

It will be seen that a net actual efficiency during actual working evaporative conditions of 85 per cent. is easily attainable with crude liquid hydrocarbon; but the best ordinary working efficiency with solid hydrocarbon or coal does not realize more than 70 per cent., so that the relative value in practice is as 85 is to 49 in favor of the liquid hydrocarbon, without allowing for the other advantages favorable to the use of oil.

The following table shows at a glance under what conditions of cost of the two fuels it is advantageous to use, one or the other:

Cost of Oil per gallon.	Cost of Oil per ton in shillings.	Oil. Percentage of advantage or vice versa.	Coal. Percentage of advantage or vice versa.
½d.	10	+ 40 per cent.	— 40 per cent.
¾d.	15	+ 36 "	— 36 "
1d.	20	+ 15 "	— 15 "
1½d.	30	— 28 "	+ 28 "
2d.	40	— 70 "	+ 70 "

In the table the coal is estimated to cost 12s. 6d. per ton delivered; firemen, 1s. per ton = 13s. 6d., and to possess the following thermic and chemical characteristics: Carbon, 80.00; hydrogen, 5.00; oxygen, 8.00; ash by difference, 7.00; calorific value, BU 14,000. The oil is good astatki or blast furnace oil, having the following chemical and thermic values: C84.95 H13.95 O1.2; calorific value, 20,000 B U. The plus signs repre-

sent advantage of use, the minus signs represent disadvantage of use. The cost for supervision of the oil firing apparatus is taken at 2d. per ton.

It would therefore appear that the price of crude (artificial) oil should not exceed 22s. 6d. per ton to enable it to successfully compete with coal delivered at 12s. 6d. per ton. Where storage space on board ship is valuable, the reduction in cubic space required for a given weight of oil may be taken at 35 cubic feet per ton; coal occupies for the same weight 45 cubic feet. In a cargo of 1,000 tons this would mean a reduction of 10,000 cubic feet.

The reduction of displacement and *pari passu* resistance of a vessel, even if the space were not available for cargo, would be of considerable value.

In long distance voyages and warships an extra weight of fuel equal to nearly one-third of the same displacement would be a considerable advantage in favor of oil.

The oil cargo may, moreover, occupy positions in a vessel quite unsuitable for coal, and as it can be pumped from the holds to the furnaces, no trimmers are required.

In ocean liners there is no doubt but that the saving in displacement would justify the use of astatki at treble the price of its equivalent thermic value, compared with coal, but even this price, or £3 7s. 6d. per ton, is considerably below the present price of astatki at the Rothschilds' new storage tanks at Barrow.

If the facilities for the transmission of the crude astatki are increased in the degree of last year, there is no doubt but that we are within a measurable period of the reduction of the price of crude liquid hydrocarbon to a figure that will admit of its economic use.

Another, and above all, important advantage of the use of crude oil for heating or fuel purposes is its sea calming attributes, the peculiar viscosity and molecular adhesiveness of oil, and the fact of its specific gravity being very much lighter than sea water, over which it spreads, reduces to a harmless degree the plowing or wave-producing action of wind currents, and many vessels and lives of men have been saved by its use.

The disadvantage attending the storage of a refined character of petroleum was strikingly exemplified by the explosion of the ill-fated Petriana at Birkenhead, and a sister vessel more recently at Calais.

The highly volatile constituents of refined petroleum are liable even at normal atmospheric temperatures to be evolved and accumulate in the holds, but as the author recommends the crude astatki from which the olefiants and other crude liquid hydrocarbons have been expelled, there is little danger that the evolution of explosive gases will occur. Nevertheless, on the examination of the holds or tanks in which the oil is or has been stored, either a Davy—for which we owe a debt of gratitude to one of our illustrious dead, Sir Humphrey Davy—or an incandescent (electric) lamp should be used.

To attain lucidity with brevity of explanation it may be premised that there are at present three fundamentally different methods of utilizing oil for heating purposes. In the first method the oil is simply allowed to gravitate descensionally over a series of superposed and slightly inclined troughs. In the second method the oil is aspired and then injected by an inspiratory and injectory apparatus, from the nozzle of which it issues in a finely divided spray condition. The operative dynamic agent may be either compressed air or steam. In the third method the oil is converted into a gaseous condition by being raised to a temperature of volatilization, either by its own or independently applied heat of combustion.

The first method was utilized by St. Clair Deville, and was employed at Baku in 1867, but the system is most imperfect, and unless there is a strong current of forced blast thick volumes of smoke are produced.

The following is a categorical list in periodic sequence of the applications with varying modifications of the second method.

Injection by compressed air was introduced in 1863 by W. B. Adams.

The oil injection system was tried with shale oil in the small Admiralty launch, the Oberon, in 1868; horse-power, 1.30; 3 furnaces; steam superheated; auxiliary boiler for injector; evaporation, 10.97 to 1; corrected from and at 212° 13 to 1. Second trial, same boat and apparatus, in 1869, evaporation, 14.36 to 1 from and at 212° 16.93 to 1; theoretic value of fuel said to be 17.4 pounds—error somewhere.

Another experiment with steam injection was carried out in the Admiralty chief constructor's yacht, steam superheated. In the boilers of this yacht, when fired with coal, an evaporation of 7 to 1 was obtained; with the oil it realized 10.2 to 1.

In 1867 or 1868, Isherwood, of the U. S. Navy, deduced from experiments on board the gunboat Pallas, the following, viz: That petroleum yielded a maximum economy over the performance of the best anthracite of 38 per cent. The system adopted was that of Col. Footes, which consisted of the use of small perforated pipes placed in the furnace and exposed to the heat of combustion. Through these pipes there was injected a mixture of air, superheated steam and hydrocarbon vapor through 90 small orifices. Isherwood, than whom no more intelligent and braver officer ever served under the American flag, was most favorably impressed with the advantage of liquid fuel. Another engineer who has, more than any other, popularized the use of oil in Russia is Mr. Urquahart, who has converted the entire number of locomotives, some 143, running on the Southeastern railway in Russia, for firing with oil, besides the 50 stationary boilers, furnaces and forges in the erecting and repairing shops.

The method used is the injection of oil by steam, air being also aspired with the oil. In starting the fires a pan with perforations through raised nipples, for the admission of air to the fuel, is provided. Into this pan oil is poured and inflames on the surface.

Mr. Urquahart's results show that the equivalent of 100 tons of coal in 1882 in the 6-wheeled engines, was 55 tons of petroleum refuse in 1887, or a reduction of 45 per cent. in weight of fuel. The equivalen saving in the 8-wheeled engine was 49 per cent. compared with anthracite. Oil firing has effected a considerable reduction in the cost of locomotive fire-box repairs.

Taking the result of one year's working with coal in 1882, and taking the cost of the coal at 15s. per ton and another year's working with Russian astatki at 26s. 6½d. per ton, the average cost per engine mile for coal would be 4.50 pence, that for astatki oil would be 4.43 pence.

The highest evaporative efficiency obtained by Mr. Urquahart was 14 to 1, the theoretic calorific value of the fuel being 17.1, so that an evaporative efficiency of 82 per cent. was attained.

Third method: Rarff's process, which consisted of a form of retort placed in the furnace, was tried in the steam yacht Minnie in 1867; the evaporation was 12 to 1.

Dorsett's system, consisting of independent generator for converting oil into gas, 2 oil gas generators used, oil gas burnt by 1-10″ jets. Oil generator pressure 35 pounds to the inch. Evaporative efficiency 144.28 to 1, reduced from and at 212° Fahr.

The author's system is based upon the third method. The *raison d'etre* of his adoption of this method is as follows: If the hydrocarbon is in a liquid condition, even if finely divided, it is most difficult except with an amount of air considerably in excess of that theoretically necessary.

A supply of air theoretically equivalent in methods 1 and 2 would produce at once a deposition of solid carbon, followed by a definite loss of so many heat units, and an interference with the progress of transmission of the heat evolved.

In the author's system the liquid hydrocarbon is injected by steam or air into the centre of a retort placed in the furnace of the steam generator. The steam and oil pass and re-pass or flow circumferentially through the retort, becoming, by contact with the sides of the latter, converted into gas. The gas issues in an annular ring from front end of retort where its flow is deflected around the retort by means of a disc valve. The gas issues in a ring-like form around the edge of the retort, which is supported by a central wall and flows along the outside of retort in a column of flame. The air flows around the disc valve and meets the annular flow of gas with the result described. The outside periphery of the flame may be preserved from contact with the flame by means of perforated refractory linings, which, becoming incandescent, prevent the action of the plates in reducing the temperature of combustion, and also prevent the oxidizing action of combustion on the flue plates. The steam is preferably kept at a temperature above 50 pounds per square inch. At a pressure of 30 pounds the steam was found to reduce the temperature of a retort below volatilization point. The disc valve can be adjusted so as to quickly establish an equilibrium between the flow of air and gas, so as to attain perfect combustion.

The system was applied to a single furnace marine boiler, having a direct heating surface of 313 square feet. Perfect combustion was attained throughout the trials. The oil used was blast furnace quality, the analysis of which, with its calorimetric value, is given in the table of analyses. The experiment was tried with natural and with forced draught; the results are as follows:

Natural Draught.—Net evaporative efficiency, 14.97 to 1, or 89.87 per cent.; net useful evaporative efficiency, after deducting steam used in injecting oil, 14.33 to 1, or 85.99 per cent.; heat absorption efficiency, measured by Carnot's law, 85.57 per cent.

Forced Draught.—Net evaporative efficiency, 14.21 to 1, or 85.25 per cent.; net useful evaporative efficiency after deducting steam for aspiration of oil, 13.58 to 1, or 81.5 per cent.; heat absorption efficiency, measured by Carnot's law, 84.53 per cent.

The author's system as applied to the submarine submerging torpedo boat is as follows: The steel retorts are on the underside, supported by a fire-brick wall.

The retort projects some four feet into the flues. For yachts and lighter craft the retort can be attached to the upper half of furnace door. The oil, air and steam connections are swivelled from the same center as the door, and the ordinary fire-bars can remain undisturbed.

In the center of the retorts of the satanella there is fixed a screw casting passing through the axis of which there is a hollow tube, through which the oil spray is injected to the closed end of retort.

The oil in contact with the heated retort becomes gasified more or less in proportion as it remains in contact with the sides thereof. This contact is secured by the circular direction which the flow of the gas has to follow; the circular motion inducing centrifugal action producing contact of the molecules of the oil with the sides of the retort so that before the oil spray escapes from the retort it is completely gasified.

The gas on issuing around the edge of the retort strikes against the movable disc valve and returns around the edge of the retort, where it is met by the air blast slightly heated issuing from the front air chamber and flowing around edge of disc valve. The disc valve is regulatable by means of a regulating wheel.

Over the vertical center of the injector that aspires and injects the oil into the retort, there is provided a small ignition spray injector. This is first lighted and always maintained alight. As soon as the retort is sufficiently heated by this ignition injector, the oil is injected into the retort and the gas resulting from the circumferential process through the retort is ignited by the ignition jet from the upper injector. By this arrangement all danger of accumulation of dangerous explosive mixtures is avoided.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, April 10th, 1889.

Gas Testing in London—A New Gas Economiser—An Analysis of London Gas—Gas Engines.

The London Gas Referees have made some alterations in the instructions which they issue to their staff of gas examiners. Probably this course was suggested by the recent investigations into the sources of error incidental to the standard candle, as the chief object in view seems to be the better averaging of the results. Hitherto the rule has been to take three tests daily, without any proviso as to time, so that they could be taken consecutively without interval between each one, if found convenient to do so. But this provision has been extended as follows: The testings for illuminating power shall be three in number daily, to be taken at intervals of not less than one hour; but if one of these tests assigns to the gas an illuminating power differing by more than one candle from the illuminating power assigned to the gas by another testing, or if the average of three testings of illuminating power fall below the prescribed standard, a fourth testing shall be made after a further interval of one hour. Another important addition to the existing regulations is the rule that the several testings on one day are to be made with different pairs of candles. Before each testing the two candles are to be so placed that the plane of the curvature of one wick shall be perpendicular to the plane of the curvature of the other wick. Ten observations at intervals of one minute constitute one test, and after five observations have been taken, the disc and mirrors are to be reversed by being turned through half a circle. Several other details are accurately laid down, and indeed, the attention to *minutae* is almost wearisome. One might almost expect that in the next set of instructions the examiner will be directed to hang up his hat and coat on a peg to be fixed at a prescribed height and at a certain position in respect to the instruments, or something of that sort. For instance, the examiner is told to put a clean chimney on the burner before each testing, to cover up the disc when not in use, to protect it from dust, that the proper rate of consumption is shown by the long hand of the meter making exactly one revolution per minute for several consecutive minutes, and so on. Instructions of this sort may be necessary for schoolboys, but surely are superfluous when addressed to competent scientific investigators.

"No experiment is to be rejected on the ground that the result seems improbable." This regulation is surprising, as being contrary to ordinary usage. In the course of experiments it is by no means an unusual occurrence for some part of the apparatus to get out of order, or for some oversight to be made by the operator. In making an elaborate chemical analysis, for example, it often turns out that some of the results cannot be accepted, and are therefore thrown aside. No one would think of insisting on averaging them in with the others. So with complicated apparatus, like the photometer, several minor casualties might temporarily affect the results. Some little scope appears to be granted to the operator, for it is stated that if any testing is rejected the cause is to be stated. The particulars of every testing are to be entered in the books. The causes for rejection that are ordered in the instructions are a candle consumption of more than 126 or less than 114 grains per hour, irregular burning of the candle, or the flames getting out of plumb.

The effect of these new regulations is that whereas the examiners could formerly complete their labors in about two hours each day, their time will now be occupied for about five hours per diem. When it is considered that they apply to a staff of about 20 skilled chemists, the practical result is that the cost of testing is about doubled, and the total expense under this head is such that it becomes a pertinent question whether some equally searching test that could be applied at a less expense is not obtainable. Within a period less than five hours, for instance, it would be possible to carry out an elaborate analysis of the gas. The remarkable feature is that all this trouble and expense is incurred on behalf of a system that has repeatedly been condemned by the chief gas examiner and other high authorities as being far from accurate.

A remarkable story of gas "economizing" comes from Liverpool, in the form of a report from the police court proceedings in that town. The Liverpool Gas Company summoned a refreshment house keeper for having "caused to be laid certain pipes communicating with a certain other pipe belonging to the Liverpool Gas Company, without their consent, and with having improperly used or burned certain gas supplied by that Company." An inspector employed by the Company, on calling at the premises in question, discovered that a connection had been made between the inlet and outlet of the meter, so as to allow gas to pass direct to the burners without being measured. By this means it appeared that the gas had been "economized" to the extent of some 8,000 cu. ft. during the quarter. The defence urged was that the arrangement had been fixed by a man who had called and agreed to supply the defendant with a "gas economiser" which he described as a new invention; and that the defendant, who was suffering from ill health, allowed him to fix the new invention without any inquiry as to its nature, and was not aware that anything in the way of fraud had been contemplated. The ingenuous inventor of the 'economiser' was not forthcoming, as would naturally be expected, and the magistrates were not inclined to consider the refreshment house keeper free from all responsibility in the matter. They inflicted fines amounting to about $36, and it is to be hoped that this will act as a sufficient warning to confiding refreshment house keepers and others not to purchase newly invented economisers without examination, or without seeing that the instrument is properly fixed in such a manner as will comply with the legal requirements of the gas suppliers. The incident also illustrates the necessity, on the part of gas companies, of employing inspectors who are likely to keep their eyes open, and to detect anything in the way of "newly invented economizers" that may happen to be fixed in the vicinity of the gas meters.

In the course of some experiments on gas engines conducted in December last by Prof. Kennedy, under the auspices of the Society of Arts, three analyses of the 16-candle gas as supplied by the Gas Light and Coke Company to the city of London, were made by Mr. C. J. Wilson, of the University College, who devised a simplified apparatus for the purpose. They were taken on the 19th, 21st and 27th inst. respectively, and go to show that the London gas supply is of fairly constant quality. The condensable hydrocarbons, which are termed by Mr. Wilson "Olefines," are given as 3.77, 4.07 and 4.04 per cent. on the three occasions respectively. There is room for improvement in the nomenclature adopted by chemists when quoting results of gas analyses. Some favor the popular and others the severely scientific form of expression. As it is, each of the hydrocarbon compounds have received several different titles. The substances spoken of by Mr. Wilson as "Olefines" are also called "hydrocarbons," "illuminants," "olefiant," "condensable matter," by various writers. Marsh gas has been described as "light carbureted hydrogen," "founene," "methane," and so on. The confusion of terminals by persons who are accounted authorities on such matters, as exemplified in the use of terms like benzol, benzene, or benzine, is especially noticeable. Surely, all this must greatly add to the labors of students, and cause a great deal of obfuscation to practical men. Indeed the want of method thus exhibited is greatly responsible for the odium that attaches to matters scientific in the minds of many busy practical workers; for it will usually be found that people are more disposed to get disgusted with things they cannot understand than with those that are plain and clear. The proportion of carbonic oxide is very low. It averages about 4½ per cent., and therefore conforms pretty nearly to the idea of the Paris *savants*, who some years ago decided that coal gas

ought not to contain more than 4 per cent. of this poisonous element. Marsh gas runs about 37, and hydrogen about 50 per cent. Oxygen and carbonic acid together do not make up one-half per cent., and nitrogen is set down as about 4 per cent. It is not generally known that in making analyses of coal gas chemists have to rely upon assumption to some extent. The marsh gas is determined by the indirect method of combustion. The residue, after treating with absorbents, is mixed with an excess of oxygen, exploded by an electric spark, and the loss of volume is supposed to give the data for the estimation of the hydrogen, whilst absorption by potash gives the carbonic acid formed. This procedure indicates how much hydrogen and how much carbon are present, but whether it is warrantable to set down the whole of that carbon as being combined in the form of marsh gas is an open question. Then, to determine the nitrogen, the excess of oxygen is removed by absorption or otherwise, or more frequently this substance is estimated by difference. I have read with interest in the lecture, given by Dr. Lewis T. Norton* on a recent occasion, a reference made to this subject, having frequently noticed the high proportion of nitrogen said to be found in samples of coal gas. The difference method saddles the accumulated errors of the whole operation upon the unfortunate nitrogen. And the absorption of the excess of oxygen leaves it open for a trace of nitrogen that may happen to be present in the oxygen to be added to that actually present in the gas. The compressed oxygen so generally used in laboratories, usually contains 1 or 2 per cent. of nitrogen, so it is a wise precaution to examine the sample of oxygen that is to be used for explosions, so as to make sure that it is perfectly pure. The heating power of these three samples of gas is respectively given as 626, 633 and 624 thermal units per cubic foot; or 19,830, 19,200 and 19,700 per pound of gas. This is a remarkably close approximation to the results obtained in the classical experiments tried by the late Mr. F. W. Hartley.

The simplified form of apparatus used by Mr. Wilson is well worthy the attention of those engaged in gas analyses or contemplating experiments in that direction. Its title is quite justifiable, as it comprises a single eudiometer tube and laboratory vessel, with only two single and one three-way cocks. The capilliary tubes can be filled with mercury, thus preventing possibility of error from that source. It does not, however, possess the convenience for the application of pyrogallic acid, cuprous chloride, and other reagents that are energetically affected by the atmosphere, which is peculiar to the Hempel bulbs.

The gas engines came out very well under these trials, and fully illustrated the convenience and economy of this form of motor. The Atkinson gas engine, running at full power, developed 1-horse power (indicated) with a consumption of about 19 cu. ft. of gas per hour. The Crossley engine consumed 20½, and the Griffin engine 22½ cu. ft. under similar conditions. The full report has been printed in the transactions of the Society of Arts, and affords a great deal of valuable information.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

The Davis & Farnum Manufacturing Company made no mistake in adding largely to the capacity of their shops, for the favor of the gas makers about to carry out a scheme of betterments is still being showered upon them. In addition to the orders on their hands as previously reported by us, we may mention that they are to furnish holders at Williamstown, Mass., and Brattleboro, Vt., while bench work contracts were received from North Adams and Holyoke, Mass., and New Britain, Conn.

At the annual meeting of the Saco and Biddeford (Maine) Gas Company, the following officers were chosen: Directors, Horace Woodman, R. Jordan, L. Bryant, E. Lowell and E. E. Foster; President, Horace Woodman; Treasurer and Clerk, S. S. Richards. A dividend of 3½ per cent. was declared, which is payable from the 1st prox. The Company will make some extensions to mains this summer.

The village of Westerly, R. I., wanted electric light for its streets, and the gas company decided to secure the contract, if possible. The specifications agreed upon called for bids on at least 12 and not more than 20 arcs of 1,200-candle power each, and from 75 to 125 incandescents of 25-candle power, to be kept alight on a schedule of hours beginning at sunset and terminating at midnight. In response to the invitation bids were submitted by the Westerly Electric Light Company and the Westerly Gas Company. The former asked $74.98 each lamp per annum for the arc service, and $15.98 for the incandescent class, while the latter offered to perform the work for $59 and $11.80. The gas company secured the awards, with the understanding that the system be put in operation 5 months from the date of the contract, else a forfeit of $50 for each 24 hours thereafter that the work remains unperformed will be collectible. The gas company will probably install an electrical plant of the Edison type.

Cheaper Gas for Haverhill, Mass.—The Haverhill (Mass.) Gas Company is again in the field for an increased share of popular favor, in that its managers have decided that from and after May 1st the gross rate per 1,000 cu. ft. is to rule at $1.50. Payment of bills on or before ten days after their presentation secures a rebate of 10 cents per 1,000, thus making the net rate equal to $1.40. This is a reduction of 10 cents per 1,000. It is, by the way, a seemingly hard and fast rule of the proprietors to cut the price 10 cents per thousand each year; and a pretty good rule it seems to be. Last year's business (year ended June 30, 1888) showed an increase in sendout of 15.14 per cent. over that of a year ago, and it is further noticeable that Haverhill's gas consumers are prompt to avail themselves of the discount; for the average price paid for gas sold there (gross, $1.60, with 10 cents off) in the year noted was $1.51. This Company also well illustrates the advantages of a fair capitalization, its entire capital account per 1,000 cubic feet of gas sold, including bonds, being $2.772.

Supt. Sanders, of the Laconia (N. H.) gas works, had to rig up a "smokestack" the other day in order that the operation of gas making might be continued. The ordinary chimney—or at least a good slice of one side of the same—caved in.

At the annual meeting of the Bridgeport (Conn.) Gas Light Company the following officers were elected: President, W. R. Higby; Secretary and Treasurer, L. N. Van Keuren; Superintendent (it seems needless to mention him), C. A Gerdenier; Directors, S. B. Beardsley, W. D. Bishop, W. H. Perry, H. Nichols, A. C. Hobbs, S. C. Trubee, H. L Clark, W. R. Higby, and W. B. Hincks. This sterling institution believes in retaining those who have served it faithfully; for the above list shows no change in those who directed the policy of the Company in 1888—in fact, these same officers have served it for many years.

The Councils Committee on Gas, Philadelphia, are still wrestling with the problem of whether or not to supply gas to the charitable institutions of the city—such as hospitals, dispensaries, etc.—at a lower rate than is charged to ordinary consumers. They, however, do not seem to make much headway in respect to a solution of the agitation, although the general impression is that in the end an adverse report will be made. One of the latest sessions of the committee brought out a letter from a certain Dr. J. W. Pettinos, who said therein that under his "patents recently perfected" he can manufacture, from the amount of coal annually carbonized at the Philadelphia gas works, over $3,000,000 worth more fuel and gas than is made at the present time therefrom. He must have something strikingly good; or in any event, his assertion is entitled to a high place in the catalogue of "important, if true." The trouble quite likely, however, is that the Doctor is an enthusiast; possibly, a crank.

The following is from a Wilmington (Del.) newspaper: "Mr. J. Edward Addicks, who contemplates controlling the gas works of New England, divides his time between New York, Philadelphia and Boston, with an occasional trip to London, where he has placed some ten millions dollars of securities. He has made and lost several large fortunes, and is now on the road to the largest deal of his life. If he succeeds in the accomplishment of his present ambition he will be worth some fifty millions, but if he fails he won't have half as much as he has now. To-day he is estimated at $12,000,000, but if the Boston politicians who are now closely associated with him have a fair chance, Addicks will return from Delaware on a free pass—if he can get one."

At a meeting of the Board of Directors of the St. Paul (Minn.) Gas Light Company—held about a fortnight ago—Mr. E. S. Frost resigned as Vice-President and General Manager, being impelled to this course because of the growing importance of his Eastern business. He was a clever manager and is a capable gentleman, and the St. Paul Company owes much of its success to his executive ability. Mr. Frost has been succeeded by Mr. Crawford Livingston, who came to St. Paul from this city in 1871. In 1884 or '85 Mr. Livingston, acting with Mr. M. S. Frost, father of the retiring manager, bought the plant and franchises of the old St. Paul Gas Company, and it is to him that the reorganization plan then adopted should be credited. Among other responsible positions held by Mr. Livingston may be mentioned the Presidency of the Duluth and Manitoba Railroad system, the construction of which was primarily due to his efforts. He is also interested in the Stickney system of rail-

*Ante, p. 309.

ways, and has been Secretary of the James River Valley Railroad. We wish him all success.

THE stockholders of the Hollidaysburg (Pa.) Gas Company have finally succeeded in ordering an investigation of the books of that enterprise. The committee intrusted with the task is: James Denniston, J. King McLanahan and G. W. Patterson. We might also say that the "management" is also to be investigated, and in further comment add that the committee evidently expects to develop gross mismanagement, if nothing worse, in the executive control during the past "12 or 13 years;" but we are decidedly of the opinion that the investigation must result in complete vindication of the men who were at the helm within the period noted.

THE rumors anent the proposed purchase of the Macon (Ga.) Gas and Water Company by the proprietors of the Consumers Gas Company, same city, are still in circulation, and it is not at all improbable that an arrangement will be effected. In fact it seems now to be merely a question of price. In the meantime, however, this agitation has awakened the Macon authorities to the fact that it might be well were the city to purchase the water works division of the Boardman enterprise.

AMONG other betterments now being carried out by the Milford (Mass.) company we may note the sinking of a tar tank, to hold 400 barrels, and a gasholder of a capacity equal to 30,000 cubic feet. This latter will enable the Company to maintain a maximum pressure of 3 inches; and it would seem in a line with economy were the main system enlarged to the diameter necessary now for the gas needs of the place.

AKRON, Ohio, is to have a fuel gas plant of the Loomis type, certain parties having obtained a franchise for its operation. It is said that an expenditure of $150,000 will be necessary.

THE labor agitators of Massachusetts have taken up the cry for the control by the State of all municipal lighting supply. When these "buncoers" attempt to shape public policy, one may feel well assured of the impropriety of the action advised. In reality it requires no argument to convince fair minded persons of the impractability of engaging the public authority in the performance of a purely commercial enterprise, and expecting that such enterprise would be carried on in a manner even measurably free from taint.

AMONG the notable things that may be seen at the Paris Exhibition, and intended to serve as a specimen of the Welsh mining industry, is a hugh block of coal weighing 5 tons 10 cwt., cut at the Abercarne Coal Company's colliery in Abercarne, Wales. The block, which was cut from the Company's 9 ft. black vein seam, measures 7 ft. 6 in. high, 5 ft. 6 in. wide, and 3 ft. 6 in. deep. It had to be hauled about a mile in the workings to the pit shaft, where it was found necessary to trim it before it could be sent up to the bank. Five blocks, each weighing 2 tons, will accompany it.

THE Amberstburg (Ontario) Council have granted the Walker Gas Company the right to pipe the town for the supply of gas, provided the pipes are put down before April 1, 1891, or within three months of the time that the same company's mains are placed in Windsor. Amberstburg is on the Detroit river, at a point 5 miles above Lake Erie, and is on the Canada Southern Railway. It is 18 miles from Windsor, and was formerly known as Malden. Population about 5,000.

IT will soon be in order, we presume, to hear from Mr. Geo. F. Card, the gentlemen in charge of the proposed electric installation for the Cincinnati Gas Light and Coke Company.

SUPERINTENDENT HAMILTON, who has charge of the public parks in Allegheny City, Pa., says that natural gas is responsible for the destruction of over 500 shade trees in Allegheny City, and that the mortality among them is increasing. When speaking recently about this, he said: "People often say to me that their trees are dying, and ask me to account for it. I generally find that there is a gas leak close to the ailing tree. When the natural gas pipes were laid the work was done hurriedly and carelessly, the result being many leaks. In loose soil of gravel or sand the gas will permeate for a long distance. It affects the roots of trees, and will very quickly kill any kind of tree. We formerly had trouble in the parks, but there is none of this sort now. When these parks were laid out the filling of some of the low spots was accomplished with cinders, through which the gas readily passed. I have seen the grass 100 feet away from a gas leak completely scorched. We had a few trees destroyed."

A HINT from the antipodes is to the effect that at the recent industrial exhibition at Melbourne, the fire clay goods (including gas retorts) that received the first and highest award were those which are represented in this country by Mr. Emil Lenz.

A FEW days ago the tenants occupying the newly-erected buildings, Nos. 511 and 513 North Salina street, Syracuse, N. Y., were distressed because of the odor of gas that permeated their apartments. It seems that plumbers, having completed the piping of the building, were connecting the meters. At the close of their day's work the job had not been finished, and the gas was shut off at the street. Some one, however, appears to have interfered with this condition of the street box, and the gas found many avenues of escape through imperfect joints into the rooms of the buildings. The odor induced two venturesome youths to start on a tour of inspection, in which a lighted candle played a prominent part. There can, of course, under these conditions, be but one result; and that was speedily developed. Our informant, in describing this portion of the affair, writes: "The young man proceeded to examine the pipes on the third floor, and having reached a point in the upper hall where two joints were spread, held his light over the spot, and you can imagine the rest." A loud explosion followed by a bright flash showed that the unerring naked light can ever be trusted to find a gas escape. The experimenter and a companion, together with two others who kept a fairly safe distance away from the light, were thrown to the floor in a blistered and burned condition; furniture in the rooms along the passageway was thrown down, and, in fact, the "third floor" was more or less wrecked. The lesson to be learned from happenings similar to these must be hard to commit to memory in the average mind; for almost every day "accidents" of this nature are reported, and although they are often accentuated by death, and always with loss to property, the experience of others seems to count for naught. It may be taken for granted, however, that the party who once finds a gas escape through or with the aid of a naked light, and escapes with his life, will, if ever called on to hunt for another, "go it blind."

ABOUT a week ago there was an explosion in the generating department of the Philadelphia gas works, under control of the Philadelphia Gas Improvement Company. The newspaper accounts thereof would cause one to believe that the entire water gas annex of the works in question had been wrecked, and that the damage was accordingly very great. The trouble, which was of moment only that it proved that any injury could transpire, was not serious, as the following account, furnished by Mr. W. L. Elkins, Jr., goes to show—this account was written on April 22, a few hours after the trouble was reported: "I desire to say that the result of the fire at the 25th Ward gas works was grossly exaggerated. Having spent the morning at the works, I found that out of 12 sets of apparatus which we have in the generating house for manufacturing gas, 3 sets are unable to be used—not from any damage to them, but from damage to pipe necessary to use in the manufacturing of the gas. There was an explosion in the blast pipe, damaging that and two or three adjoining pipes. The result, however, does not affect our ability to give gas to the city. The works are in full operation for the required amount of gas to be furnished to the city, and the damage, which only amounts to $2,000, is being repaired."

THE Elmira (N. Y.) Gas Light Company will put in an electric lighting plant, the agitation for arc lighting on the streets having taken on a very positive tone.

THE Newark (N. Y.) Village Board has been inquiring about the cost of lighting the village streets by the arc system. The most favorable bid yet received was that submitted by the organizers of a local electric lighting company, who propose to supply 40 arcs (2,000-candle power standard, to burn from sunset until 11 P.M.) at the rate of $60 per annum each. The Brush system is, we believe, to be relied on.

AMONG the sterling business enterprises of that busy spot designated on the map of Tennessee as Jackson, one must include the Citizens Gas Light Company. This plant was completed in 1872, at an initial cost of $42,000. Unfortunately the originators determined to experiment with wooden mains, and their inefficiency being shortly proven, an additional expenditure of several thousands of dollars had to be made to replace them with suitable cast iron conduits. The Company, to which Jackson owes much of her popularity and reputation as a city of progressive business men, keeps step with the march of improvement. A year ago its manufacturing plant was doubled (it now can be depended on to supply 50,000 cu. ft. per diem) and an electric lighting station was added, which belongings in their entirety represent an investment of $75,000.

The work of extension still goes on. During the present season additions will be made to the lines of gas mains; a new dynamo will be placed, and other general repairs be provided for. The experimental stage has been passed, and the enterprise looms up as a monument of Jackson's solidity as a business center. The gas supplied by the Company is equal to any in the South, and the electric lights cannot be found fault with. The general service is in every way satisfactory. The management is thus arranged: President, John Y. Keith; Vice-President, John L. Wisdom; Treasurer, N. S. White; Secretary and Superintendent, A. Robertson; Directors, John Y. Keith, John L. Wisdom, John H. Duke, N. S. White, and R. A. Allison. All these are substantial business men of our city, and who, having the interest and welfare of the city at heart, will not relax their endeavors to promote its advancement and progress, and will be found in the front rank when Jackson reaches the goal of its ambition—a metropolitan city of 50,000 inhabitants—progressive, industrious, and alert, working each with a will to place our beautiful city on the highest physical, sanitary, and industrial civilization.—F."

PERTH AMBOY, N. J., is now lighted by means of 150 arcs of 2,000-candle power each, although candor compels the admission that this number is hardly sufficient. The remarkable thing, however, is the fact that the lighting—and this is excellent, when examined from the standpoint of the efficiency of each lamp—is maintained from an Ide engine (150-horse power, and having a maximum speed of 240 revolutions per minute), working at a speed of 140 revolutions per minute to rotate the dynamos at a speed equivalent to 600 revolutions per minute.

THE Corsicana (Texas) Gas Light Company has been put in the hands of a receiver. We understand that Mr. Jink Evans has been named to the receivership. This Company ought not to be in bad circumstances; on the contrary there is every reason why it should be a very valuable property.

OGDEN CITY, Utah, having asked for arc lighting figures for the public lighting—lamps to burn all night and every night, to be of 2,000 candle power each, the contract to run for three years—the local electricians replied that they could furnish 35 lamps at the rate of $216 per annum each, the rate to be $228 each should the number of lamps required be cut down to 20. Having gone thus far in the matter, and when it was found that arc lighting was rather an expensive affair, the authorities asked for proposals from the Gas Company (which agreed to submit a schedule when the matter had been carefully thought over), and on the receipt of the latter the authorities will determine "whether arc lamps or gas lights are most feasible."

PARLOR C, of the Continental Hotel, Philadelphia, was, on the morning of the 16th inst., the scene of an interesting gathering. Briefly stated, the room was comfortably crowded with the engineers of the various gas works throughout the country that are under the control of the United Gas Improvement Company; and the assemblage was convened simply for the purpose of conferring together very much after the manner of our gas associations proper. The sessions lasted for two days, and were very enjoyable.

THE residents of Chicago are grumbling greatly over the rule promulgated by the Gas Trust that requires a deposit from the consumer as a guarantee that he will pay for the gas used by him. We suppose this requirement seems all the more acid because in the days of the gas war—or the mistrustful times—deposits on meters were seldom exacted; but whether so or not, the howl now is long and loud. The real state of the case, and the reasons necessary for the practice, as explained by President Fay, of the Trust, are the following: "A deposit sufficient to pay for the gas consumed in 45 days is required. A consumer is not required to pay for a month's gas until the 12th of the month following, and then it may be the 25th before his gas is discontinued, if he has not paid up. The Company must have some protection against the people who will not pay for their gas. There has never been a time when deposits were not required from some classes of consumers, but the intention now is, and has been for about six months, to extend the system. We now insist upon deposits from saloon keepers, small business men, the keepers of sporting houses, those who live in flats, a few residents in houses, and boarding-house keepers. These people are coming and going. We have 20,000 meters in use, and it is impossible for us to watch all the meter-users. Therefore, we must have a guarantee. Under the old system of running the businsss the gas companies some years lost 10 per cent. The amount of money deposited with this company all told is perhaps $100,000. On this we pay 5 per cent. interest, according to the State law of 1871 governing the deposits made to gas companies. The interest is paid annually, or whenever the meter is given up. It is useless to say that the money is worth more than that to use, for as a matter of fact, we can borrow money for 3½ to 4 per cent., and all we want of it. The fact that we pay more than the money is worth induces us to keep the aggregate of the deposits at a minimum."

"THE installation of that Loomis plant at the works of the American Watch Company, Waltham, Mass., seems to have spurred on the agent of the Disstons—for many folks now look upon inventor Loomis as enjoying that relation to the famous sawmaking capitalists of the Quaker City—to ask for a charter for a fuel gas plant of the Loomis type for Waltham. In any event, Mr. Loomis and others have applied to the Board of Aldermen of that city for an ordinance for such an enterprise. The Company is to be capitalized in $500,000 or thereabouts, and it is proposed to sell gas at from 35 to 50 cents per thousand cubic feet. They (the managers) are kindly to allow the people of Waltham a chance to subscribe for the stock, but I should advise the Walthamites to permit the Disstons and the other backers of Mr. Loomis to take the entire investment. If it is such a real good thing, they can and ought to be allowed to absorb it, greatly to their subsequent enrichment.—HADDAM."

THE Tybee (Ga.) Artesian Water, Ice and Lighting Company has been incorporated. Its incorporators (Messrs. John G. Butler, James H. Furber, W. Kehoe, R. P. Lovell and A. C. Ulmer) propose to sink artesian wells, manufacture ice, and operate gas and electric light works. Tybee is an island on the south side of the entrance to the Savannah river. It is a small place, and our opinion of the incorporation is that the only profitable working clause that can be taken advantage of is the scheme for supplying water.

MR. I. J. NORTON has resigned his position as bookkeeper and office manager of the Rome (N. Y.) Gas Light Company. Mr. E. H. Walsworth, formerly stenographer at the Grand Central depot, this city, has been appointed in his stead.

THE Providence (R. I.) Gas Company has a system of mains that covers 167 miles of territory.

THE Quimper Gas Company, of Port Townsend, Wash. Ter., has been incorporated with a capital of $60,000, by Messrs. J. J. Kuhn, W. I. Hastings and C. A. Dyer. Its objects are to build, operate and maintain gas works for the manufacture and sale of gas in the city of Townsend. This is the capital of Jefferson county, W. T., is on Puget Sound, close to the strait of Juan de Fuca. It is 74 miles north of Olympia, and 44 miles northwest of Seattle. It has a population of about 5,500, and has every indication of growth.

THE Fargo (Minn.) Gas and Electric Company will, on property adjoining the present gas works plot, erect an electric lighting station, having secured control of the electric light company's franchise. The building and plant will be in readiness to operate by June 1st.

AS previously noted in the JOURNAL would be the case, the property, plant and franchises of the Cottage City (Mass.) Gas Company were sold at auction on the 19th inst. The purchaser was the Cottage City Gas and Electric Light Company, and the price paid was $22,350. The managers of this Company are: President, H. A. Holcomb; Vice-President, S. C. Hart; Clerk and Treasurer, J. A. Brownell. Directors, C. W. Howland, J. H. McKenzie, M. G. Howe and H. A. Holcomb—all residents of New Bedford. The present Company will, besides refitting the gas works, furnish electricity for light and power.

THE regular quarterly dividend (1¾ per cent.) of the Municipal Gas Company, of Albany, N. Y., is due and payable on the 1st prox.

AN odd law on the statute books of Windsor (Ont.) is to the effect that neither the gas company nor any other company shall tear up the streets for the purpose of relaying their pipes. Unaccounted-for gas ought to be quite a factor in Windsor.

THE Mayor of Lockport, N. Y., having been beaten by the local Council in his attempt to create a municipal lighting station, as a last resort appealed to the Legislature for authority to bond the city for the purpose stated. When the project was reached in the Cities Committee of the Senate, the chairman, Hon. Francis Hendricks, of Syracuse, opposed consent on the ground that the city should only issue bonds to maintain a water works. This view was acquiesced in by a majority, and an unfavorable report was ordered.

THE Directors of the Amherst (Mass.) Gas Company have decided not to issue the $16,000 of stock recently provided for. Some of the stock had already been subscribed for, and the moneys received therefor have been returned.

The Market for Gas Securities.

Consolidated keeps strong, with every indication of a further advance. To-day (April 26) the opening transactions were at 89¼, and a good demand was apparent. It ought to reach 92 before the next dividend, the rate of which is now more than ever like y to be augmented. Equitable is steady to strong, but the difference between buyers and sellers is rather marked. Mutual is strong at last reported bid price, and some inquiries from out of town are now in the market for it. In Brooklyn shares no marked change has taken place, and it might be further noted that the Francklyn party are still figuring for control in one or more companies on the east side of the big bridge.

The Rochester deal, which was to have been consummated last week, is not yet a fixed fact, the time of final payment having been extended to May 3d. As a portion of the purchase money has been deposited in the Flour City bank, it may be taken for granted that the project will eventually be completed. The St. Louis situation is so mixed that we shall not venture to say anything about it just now. The very parties to it cannot tell exactly where they stand. We regret to have to record the death, on the 24th inst., of Mr. Samuel M. Vail, a valued Director in the old Troy (N. Y.) Gas Light Company. He was in his 55th year, and was highly respected. Chicago Trusts are up to 50, and the wiseacres have it that these securities are hereafter to be certain dividend payere. We hope so. The guaranteed 5's of the old Chicago Company are at 93¾ to 94¼. At auction: $900 first mortgage 5's Westchester (Yonkers, N. Y.) Gas Company, at 90; $800 seconds, same Company, at 50; 65 shares Citizens, of Rochester, N. Y., at 36.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 Wall St., New York City.

April 29.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	89¼	—
Central	500,000	50	—	—
" Scrip	220,000	—	47	57
Equitable	4,000,000	100	115	117
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	116	118
Mutual	3,500,000	100	102	103
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern	125,000	50	30	—
" Scrip	108,000			
Yonkers		50	90	100
Richmond Co., S. I.	346,000	50	55	60
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	—	104
Citizens	1,200,000	20	60	70
" S. F. Bonds	320,000	1000	—	103
Fulton Municipal	3,000,000	100	123	125
" Bonds	300,000		—	106
Peoples	1,000,000	10	71	73
" Bonds (5's)	368,000	—	97	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	88	90
Nassau	1,000,000	25	111	113
" Ctfs	700,000	1000	100	103
Williamsburgh	1,000,000	50	119	122
" Bonds	1,000,000	—	109	112

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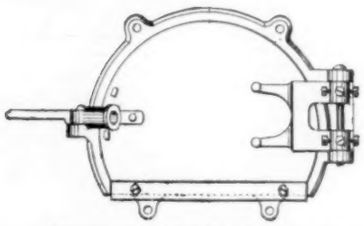

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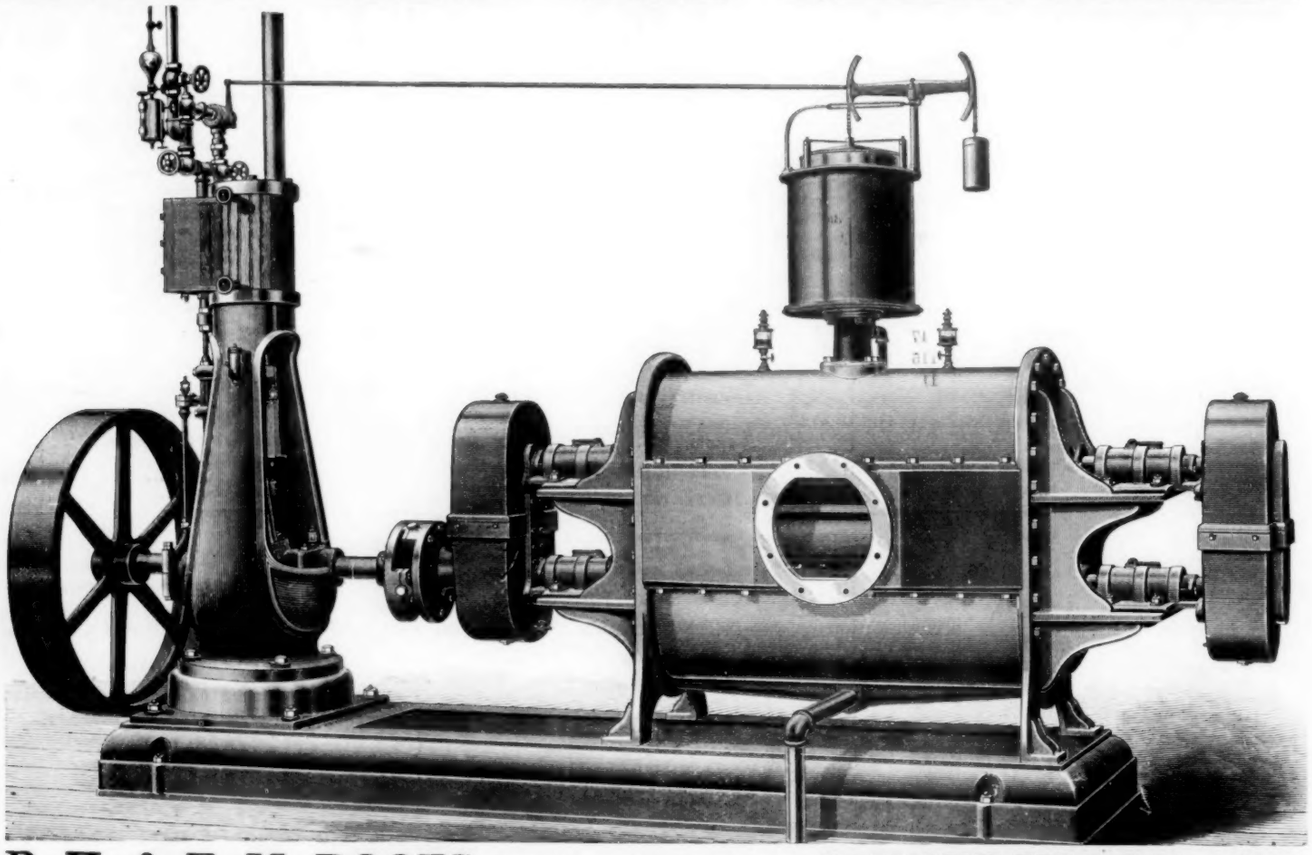

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Our Patent System of Instantaneously Lighting Gas (without electricity), for Railroad Depots is unequaled.

Dyott's High Candle Power Burner is a very superior lamp where a concentrated and brilliant light is wanted in Hotels, Stores, Depots, etc.

Special Drawings furnished and Estimates cheerfully given, either from Architects', Engineers', or our Draughtmen's Plans.

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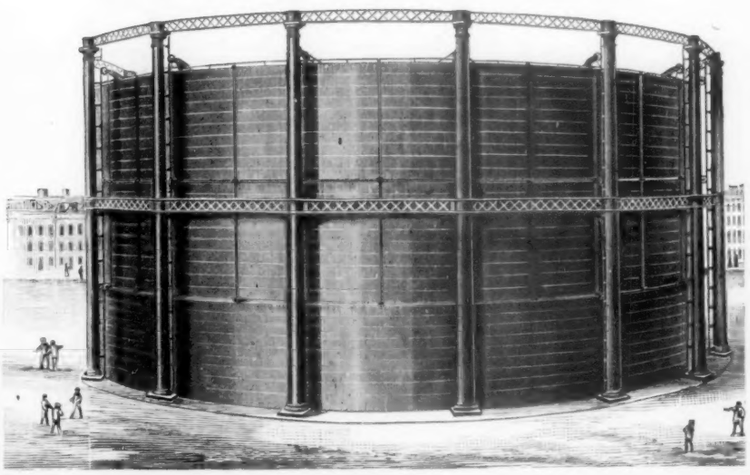

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WALKER TAR AND CARBONIC ACID EXTRACTOR.

A very general demand exists, in both large and small Gas Works, for an apparatus that will be absolutely efficient in the removal of the tar which passes the hydraulic main and condenser. Many attempts have been made to accomplish this, but, I believe, without success, until the introduction, five years ago, in England, of the C. & W. Walker Patent Tar and Carbonic Acid Extractor. During these years this apparatus has been adopted by many of the most prominent Engineers, not only in England, but also on the Continent of Europe and in other parts of the world. It is only necessary to give here a partial list in order to convince any intelligent American Gas Engineer that this machine must have succeeded fully in accomplishing the desired results.

The following Engineers have personally given permission to refer to them:

G. C. Trewby, Esq., Engineer-in-Chief of the Gas Light and Coke Co., London. The manufacturing plant at Beckton is built in complete sections of 3,000,000 cubic feet capacity each. A Walker Tar Extractor has been fitted to each one of these sections. This was done after a long and thorough trial on one of its sections. The Tar Extractor has been supplied to other works of the Gas Light and Coke Co., including those of which John Methven, Engineer of the Gas Light and Coke Co. at the Nine Elms Station, is in charge. Also to G. E. Stevenson, Peterborough Gas Works; B. Green, Mitcham and Wimbledon Gas Works; W. H. Smith, Bedford Gas Works; F. Linging, Norwich Gas Works; J. T. Browning, Colchester Gas Works; S. B. Darwin, Portsmouth Gas Works; J. McCrae, Dundee Gas Works; W. J. Wells, Stamford Gas Works; J. M. Darwin, Longton Gas Works; J. Paterson, Warrington Gas Works; and J. Coulter, of the Dundalk Gas Works. All of the foregoing gas works are located in Great Britain.

Mr. Charles A. Gerdenier, Superintendent of the Bridgeport (Conn.) Gas Light Company, writes as follows, under date of Dec. 3, 1887:

"The C. & W. Walker Tar and Carbonic Acid Extractor has been in operation at these works for the past six weeks, and is an unqualified success. It removes every particle of Tar from the gas in once passing through the apparatus, and a large percentage of the Carbonic Acid. I also feel quite sure that it prevents the formation and deposit of Naphthaline, because since I started the Washer I have had no stoppages from this cause. These works have been seriously troubled with Tar for many years, and I have used several kinds of apparatus and every expedient which has come to my attention for dealing with the difficulty, but without success. The Walker apparatus occupies comparatively small space, is less expensive than other systems, and requires but little attention. I carry 2½-inch seal, and have an automatic tar delivery valve. This Tar Extractor is indispensable to gas makers."

I have taken the Agency for the United States for this apparatus, and am now prepared to make contracts to erect it on the premises of any Gas Company. It would be manufactured in the following sizes:

No. 1,	50,000	to	100,000	cu. ft.	per	24 hrs.,	3	ft.	square,	5	ft. deep.
No. 2,	"	"	125,000	"	"	"	4	"	"	"	"
No. 3,	"	"	250,000	"	"	"	5	"	"	"	"
No. 4,	"	"	500,000	"	"	"	6	"	"	"	"
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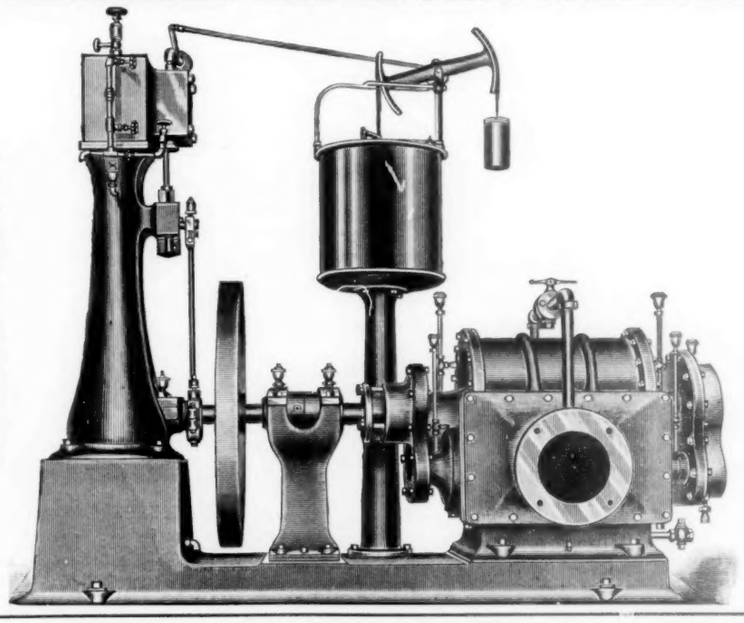

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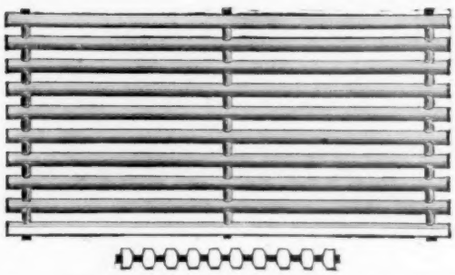

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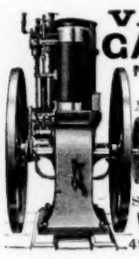

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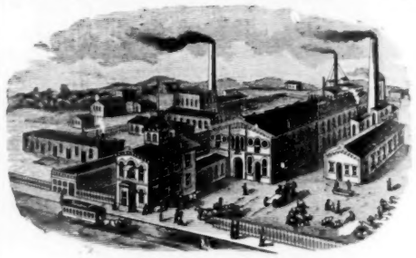

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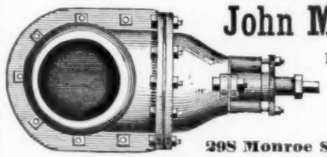

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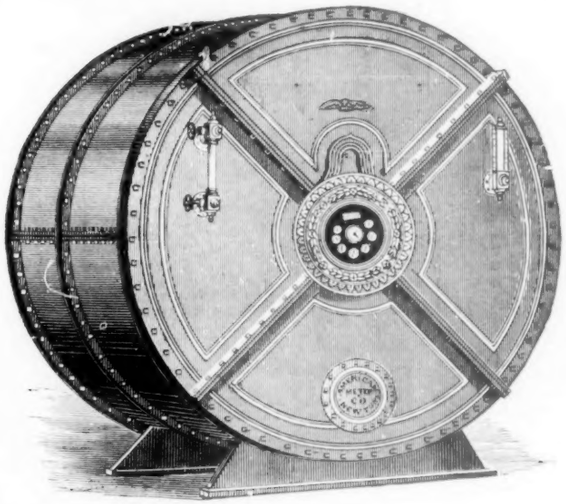

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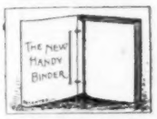

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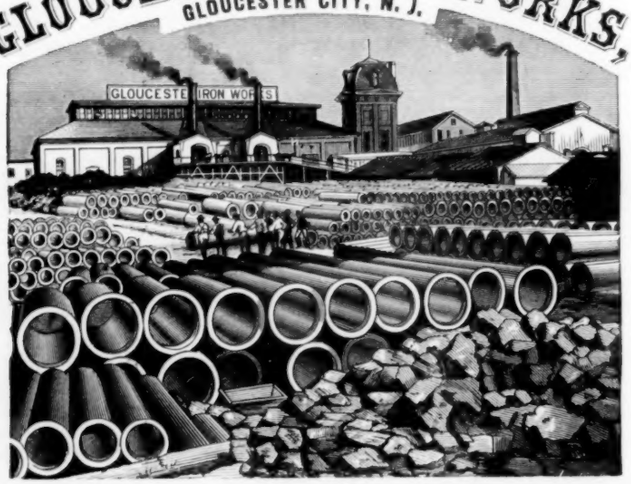

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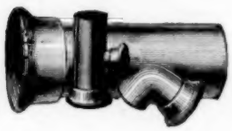

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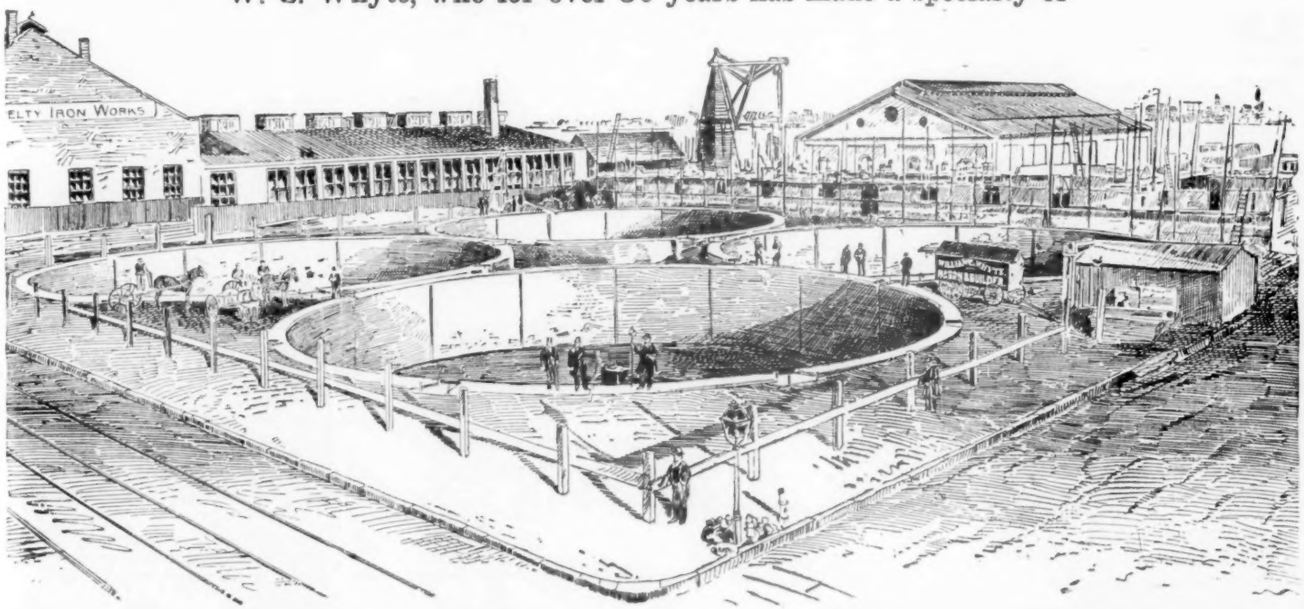

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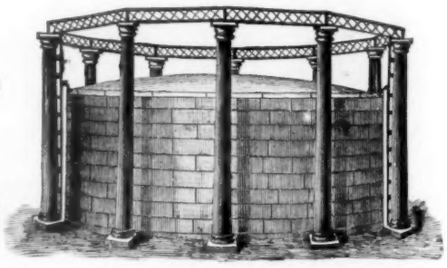

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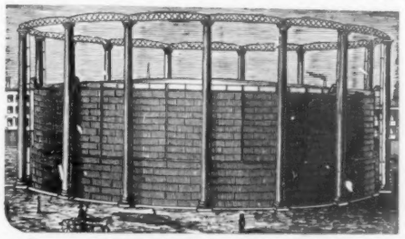
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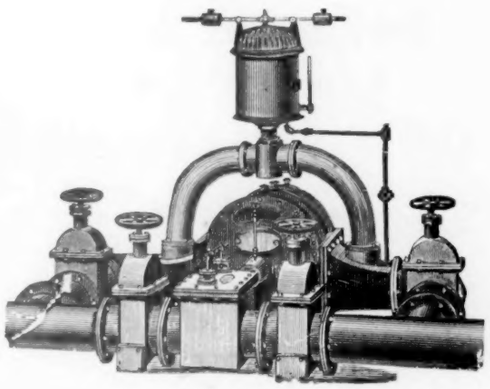
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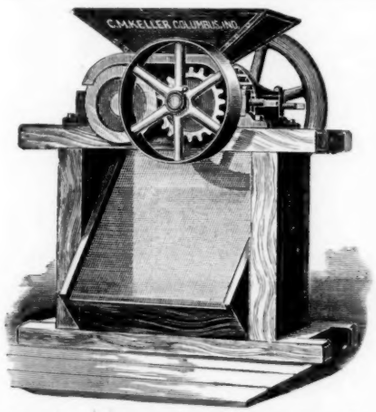

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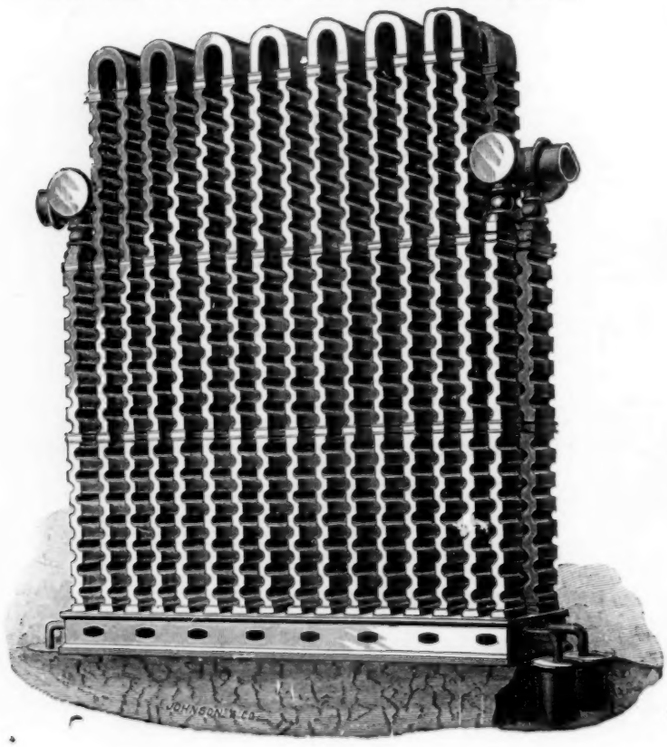

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SOLE MANUFACTURERS OF THE

"SUN DIAL" GAS STOVES,

The Most Economical, Efficient, and Durable Gas Stove Made.

GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves.
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
20 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

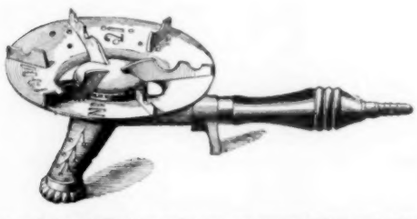
Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves.
31 in. high.	9¼ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.



"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 3 inches high. Consumption, 6 feet per hour at 1 in. pressure.

HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

¾ in. supply pipe should be used where the pressure is 1 in. or over.